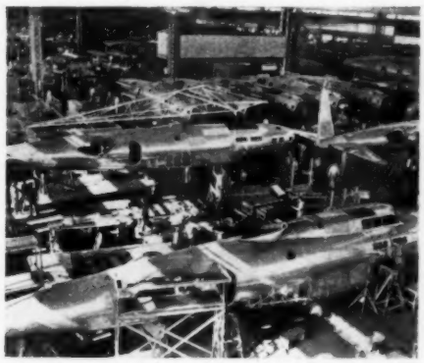
AMERICAN MACHINIST

July 10, 1940



Bombers — *Assembly of Boeing's modern "Flying Fortress" bombers is speeded with large welded jigs for lining up components for each subassembly*

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R. A. BECKWITH, *Superintendent*
Koehring Company
Milwaukee, Wis.

"I get information from articles and advertisements in *American Machinist* which often helps us in our manufacturing operations."

R v.84 pt.2 July-Dec. 1940

WHAT'S IN THIS ISSUE

THE TOOLMAKER SUGGESTS

Every toolmaker has, I am sure, prayed often and fervently for a tool designer who knows what it's all about, who can figure out which tolerances have to be close and which do not, who never tries to put a guide pin and a drill bushing in the same hole. What's more, I'll bet every toolmaker has at some time or other started for the engineering department with a ball-pein hammer in his hand and murder in his heart.

Thus it is a real pleasure to read over an article that spends its time talking the facts of life for tool designers. G. P. Lehmann, of GE's Plastics Department at Pittsfield, Mass., does just that in talking about "Mold Design for Plastics," page 489. It tells one after another of the little things that are so important to the balance sheet—the tricks that make the difference between profit and loss on a particular molding job.

It's factual and practical, and shows that Mr. Lehmann has had the practical experience at toolmaking that he privately feels every good tool designer must have under his belt.

G. P. LEHMANN

PRODUCTION CONTROL

Ten years ago, Chester Lord (then associate editor on AMERICAN MACHINIST) and I used to argue about management by the Exception Principle. It was Chester's idea—and he'd tried most of it in practice with good results—that production departments should be organized on a progressive basis. As long as parts came off the line without trouble, keeping things rolling was a clerical operation. But when inaccuracies or shortages developed, executives were brought in to handle the problem, first the supervisor, then the foreman, and so on, as high as necessary to break the bottleneck.

Chester is gone now, but one of his ideas still sticks in mind—that of a control board which would show everything about a production job at a glance. Herbert Chase reports another example on page 495—a bar-chart control board designed by S. A. Crosby, chief engineer of Speed Products Co., which utilizes lengths of colored cord to track thousands of small parts through various shop operations. It's quickly adjustable, gives a running check on what's going on—and it's simple and economical to make. It may be the answer to *your* production-records problem.

CART *AND* HORSE

So much has been written about the relative merits of various cutting materials, that considerations of their pros and cons often obscure the more basic problem of selecting the proper machine. D. W. Mellor of Jones & Lamson endeavors to get horse and cart in proper relationship in "What Tools for Turning," beginning on page 496. It lists and discusses all the factors which must be considered in deciding between automatic lathe and turret lathe for a particular operation.

FIERCEST

As the war drums roll, Uncle Sam begins to look to his defenses, which today must include airplanes by the thousand. And fiercest of his fighting planes is the Boeing "flying fortress," for which air armadas of the world have nothing but the greatest respect. One immediate task is to produce the fortress on a production basis. At the moment, Boeing is turning out one every four days, major credit for which must be given the huge steel jigs pictured on pages 498 and 499, which bring mass-output advantages to limited-lot construction.

SIDNEY'S SOLUTION

All the bureaus and coordinating boards in the country can't turn out one good journeyman machinist—because training a mechanic is a local and an individual problem. It takes cooperation between local plants and local schools to provide the groundwork, then careful handling all along the line. There must be proper balance of school theory and shop practice, of technical training and practical experience. The small town of Sidney, Ohio, home of Monarch Machine Tool Co., faced just this problem—and emerged with what Wendell E. Whipp, Monarch's president, calls a practical solution. But let Mr. Whipp tell you about it, beginning on page 493.

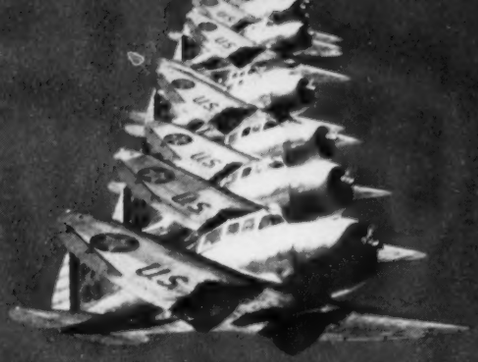
WENDELL E. WHIPP

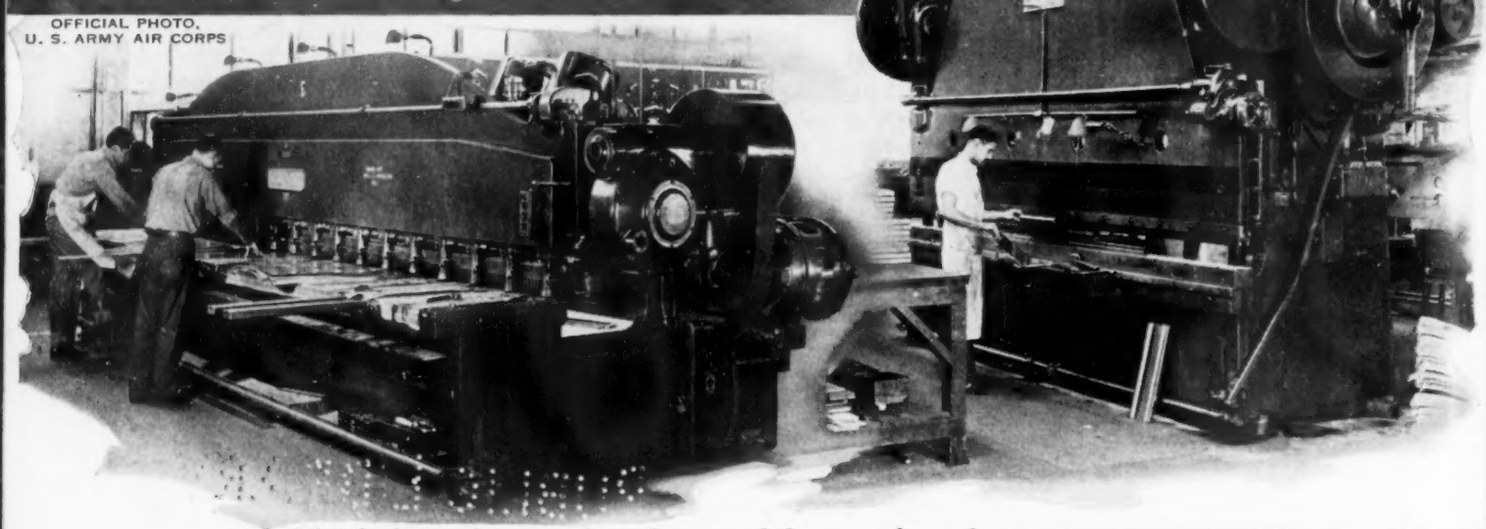
ALSO . . .

Joseph I. Karash goes on with his series on die design, discussing "Tips for the Die Designer," page 500. J. G. Magrath of Air Reduction discusses flame gouging in the second part of his article on modern applications of the oxyacetylene torch. Also some tips on quick "running-in" of new machines, beginning on p. 507.

COMING

A "humdinger" is the article on apprenticeship in the manufacturing industries by Walter Simon, Wisconsin State Supervisor of Apprenticeship. Watch for it in AMERICAN MACHINIST for July 24. In the same issue will be top-notch articles on time quenching from Republic Steel, how to hob small gears, the second part of our series on high-temperature lubrication and the fourth of Mr. Karash's series on die maintenance, as well as another one of the extremely popular pages of "Short Cuts for the Small Shop."





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ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Practical molds for plastics

BY G. P. LEHMANN, PLASTICS DEPARTMENT, GENERAL ELECTRIC COMPANY

Well designed molds, properly constructed, are indispensable to trouble-free operation in a plastics plant. The designer should have molding experience

THERE ARE seven principal types of molds in use in the plastics industry. These are: (1) the flash mold; (2) the landed plunger mold; (3) the loading plate mold; (4) the straight plunger mold; (5) the injection mold; (6) the transfer mold; and (7) the sub-cavity mold. Because it is uneconomical in the use of molding material, the sub-cavity type mold is not in common use.

The flash mold is the simplest to build and operate. It is, therefore, widely used. As shown in Fig. 1, this type of mold is characterized by a mold cavity the sides of which terminate sharply on a level with the top surface of the lower mold member. The plunger completely enters the mold cavity, forcing the molding compound up the sides until the excess material is pinched off to a very thin fin or "flash" between the cutoff surfaces of plunger and cavity. The entire pressing force is supported by the horizontal meeting surfaces. It is wise to distribute this pressure over a larger area by leaving raised pads of approximately the same height as the cutoff surface.

When designing this type of mold keep the following considerations in mind. The cured compound exerts relatively high frictional resistance to the opening of a mold, so the top and bottom plates must be heavy enough and fastened securely enough to the mold parts to withstand the forces exerted by the pull-back cylinders. Also, guide pins and guide pin bushings should be fastened securely. They must be so ground that they will position the two halves of the mold perfectly while allowing them to slip freely together.

The bottom steam retainer shoe should be provided with raised pads at the same height as the top of the cavity so as to distribute the pressure which otherwise would be concentrated on the cutoff surfaces of the mold cavity. Steam retainer shoes which frame the plunger and cavity should have the recesses which contain these members machined to exactly the same size, so that the plunger and cavity may be ground at the same time.

The designer should check the mechanical stresses in all parts of the mold, paying especial attention to the distance between parallels, and adding extra supports in case they are found necessary. Knock-out bars should be checked to be certain that they will not bend under the stress of removing the molded part. Knock-out pins with well riveted heads should be fastened to this plate by the pin retainer plate, the holes in which should be enough larger than the pins that there will be allowance for the expansion of the mold when heated. Steam lines should be placed beneath the cavity wherever possible, but always around the cavity and plunger.

Clean-out slots must be provided, between the top plate and the plunger retainer shoe, if it is necessary that mold pins enter the plunger for proper line-up or for any other reason. Safety pins are used to prevent

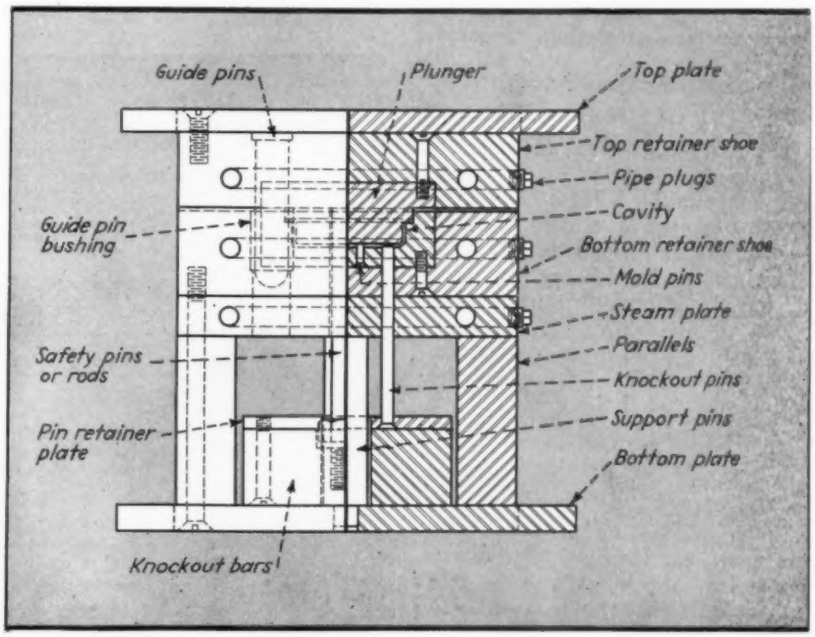


Fig. 1—Cavity in a flash-type mold has sides which terminate sharply with the top surface of the lower mold member. Excess material is pinched off to a thin fin when the plunger has entered the mold cavity. These molds are simple to build and operate

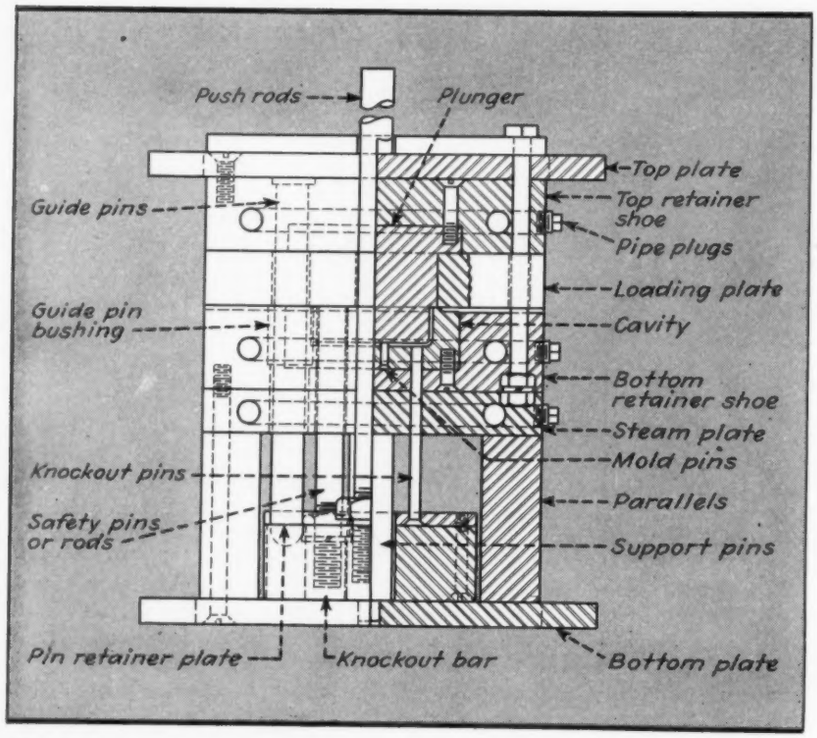


Fig. 2—In the loading shoe type mold the loading plate rests on bottom steam retainer shoe and the cavity. Push rods reset the knock-out bar

damage to knock-out pins and mold cavities by pushing the knock-out bar back into the molding position as the press closes. They should be large enough to withstand the mold closing pressure. Finally, all assembly screws must be of such size that they will withstand the stresses set up in opening or closing the mold.

Loading Plate Molds

In cases where the design of a mold cavity is such that an unusually large space is required for the molding compound, it is more economical to use a loading plate mold as shown in Fig. 2, than to machine this space in the cavity. The loading plate rests on top of the bottom steam retainer shoe and the cavity, but is carried with the top mold member when the press opens, thus permitting the use of shorter knock-out pins. Push rods are used to reset the knockout bar.

Guide pins must be long enough so that in closing they will pass through the loading plate and into the lower mold member before the plate comes in contact with the cavity. Loading plate molds must be so designed that when the mold is open there is room for the press operator to work both between the plate and the bottom of the plunger and between the plate and the top of the cavity. The plate itself should be long enough to accommodate push-down rods on each end.

Landed plunger molds, Fig. 3, are very little different from flash molds. Whereas, in a flash mold the cutoff occurs at the upper level of the bottom mold member, in a landed plunger mold this cut-off occurs at a pre-determined distance below the top of the cavity. Although some complications arise from excess molding material being trapped in the cavity, a passage can be provided to allow the excess to escape. However, it is sometimes best to design the mold without these passages and later provide the size found necessary by actual trial in sampling. The landed plunger mold is especially adapted to the molding of parts with thin sections since the line-up of mold members is very accurate.

What has been said in the preceding paragraphs concerning flash type molds and landed plunger molds can be said about straight plunger molds, Fig. 4, with the exception that in a straight plunger mold the plunger enters the cavity without resting on a land or horizontal cutoff. This construction causes full pressure to be exerted on the molding compound and results in greater densification of molded parts. It also results in varying wall-thicknesses, which may be objectionable.

Injection Molds

Thermoplastic molding compounds are most economically molded in injection molds like that in Fig. 5. Such materials generally require much higher pressures than do standard compression molding materials. The presses which are available for injection molding have such restricted spaces between strain rods that an entirely different technique must be em-

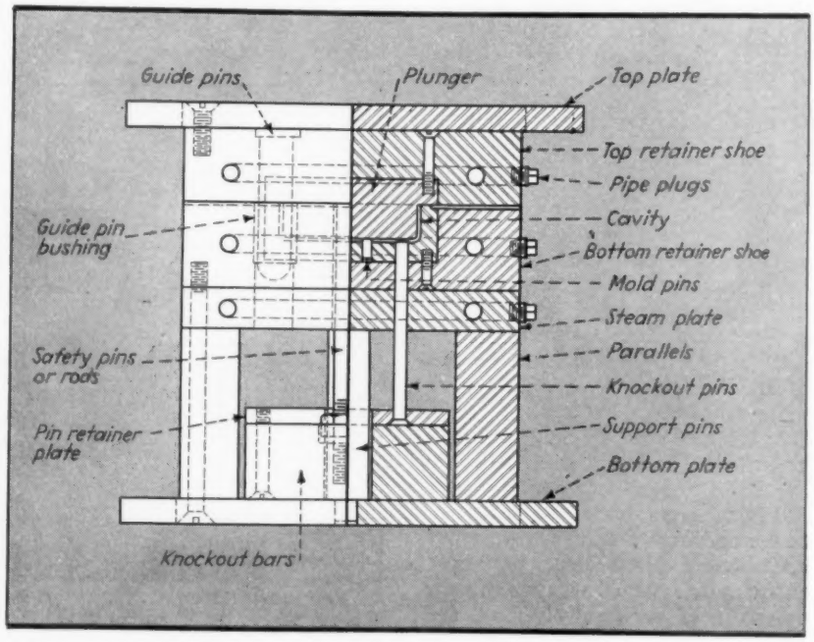


Fig. 3—Accuracy of alignment of mold members makes the landed plunger mold especially suitable for parts with very thin sections

ployed in design of the molds. Among the many items to be considered are proper support to withstand the higher pressures, the correct design and placement of sprues and gates, interlocks where line-up is important, and sufficient anchorage of movable mold members. In view of the extremely high pressure involved, it is especially important that the mold members should be properly lined up, and that the butting surfaces of the meeting members should be perfectly finished. Because of this close fit, it is necessary to provide means for venting the air that would otherwise be trapped in the mold when it is closed in the press.

Transfer Molds

Transfer molding is similar in many respects to injection molding, but differs in that transfer molding is applied to the injection of a heat-softened thermosetting material into a heated mold, whereas injection molding is applied to the injection of a heat-softened thermoplastic material into a (normally) cold or chilled mold. Fig. 6 shows an example of a transfer mold with a transfer plunger entering transfer well and with limit stud. The advantages to be gained from the use of transfer molding are that cleaning costs on the molded parts are greatly reduced, more delicate inserts and pins may be used than would otherwise be possible, and closer tolerances on dimensions of the finished part can be met.

The molding compounds used in compression molding of plastics products have an abrasive action on the surfaces of the mold members. After a few hundred thousand parts have been molded in even the best of hardened steel molds, a perceptible amount of wear takes place. In order to reduce the wear of compounds and to lengthen the useful life of a mold it is well to apply a fairly heavy chromium plate (0.001 to 0.002 in. generally is considered sufficient) to all parts of the mold that come in contact with the compound.

An exception to this rule is the case in which it is desired that the molded parts either remain in the cavity or be extracted on the plunger when the mold is opened. In such cases, the molded part will remain on the mold member which is not plated. The advantages to be gained from the use of chromium plating are longer mold life because of greater hardness, greater abrasive resistance and greater corrosion or staining resistance, and decreased manufacturing cost of molded parts because the lower coefficient of friction allows easier extraction. The length of time required to "break in" a mold has been cut down by chromium plating

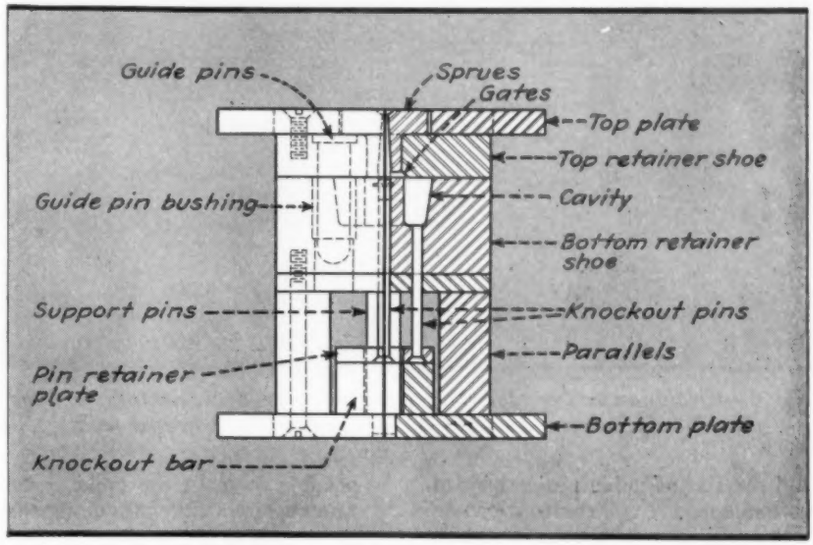


Fig. 5—Because of the high pressures used, it is important that members of injection molding dies be perfectly finished and aligned

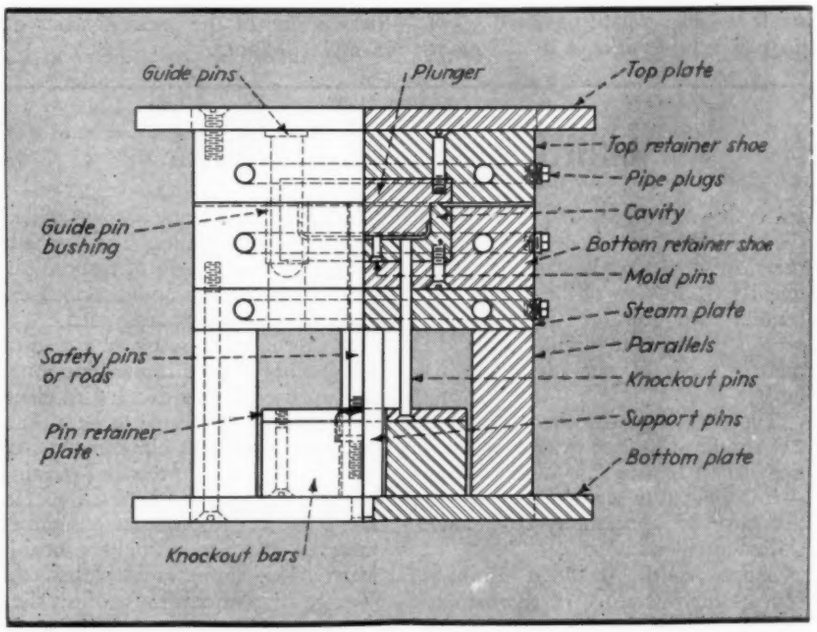


Fig. 4—In a straight plunger mold the ram exerts full pressure on the moulding compound, resulting in greater density in the product

from about two weeks to two or three hours. Worn mold members can be built up to the proper dimensions by chromium plating and will then usually outlast the original unplated mold.

Design Considerations

In the design of any of the previously mentioned molds, a number of items must be kept constantly in mind by the designer. The type of molding material must be known, since any two or more materials which might be used might require different molding pressures and temperatures. These materials might require different shrinkage allowances to compensate for the decrease in size of the molded part when it is extracted from the mold.

The designer must know whether the molding material will be in bulk form or whether it will be compressed into a preform. The form of the molding material determines the loading space required. The location

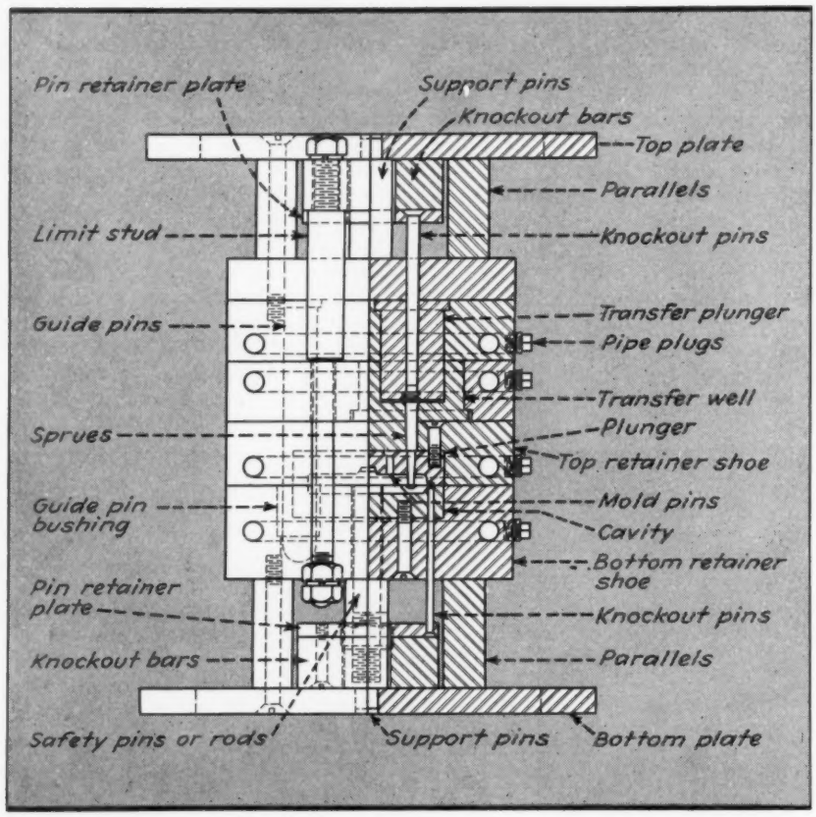


Fig. 6—Cleaning costs are low for plastic parts produced in transfer-type molds which inject heat-softened material into a heated mold

and the size of guide pins are based on the mold size and construction. As mentioned above, heating channels should be formed around the cavity and plunger and beneath the cavity. In all cases where the cavity is machined out of the same block as the steam retainer shoe, ample distance (at least $\frac{5}{8}$ in.) should be allowed between the cavity walls and the heating channels. The design should be studied to determine the proper location for knockout pins. These pins should be ample in size and in number, in order to assure proper ejection of the molded part with little or no pin maintenance.

Mold pins, or projections in the mold which form holes in the molded part, should be checked for proper proportions. It is important that the lengths of slender pins do not exceed twice their diameter. Draft or tapered sides should be used where allowed by the design and in the largest amounts possible, in order to facilitate extraction of the molded part. The necessity for and the location of pull pins and wedges must be determined. The desirability of making a mold member in sections or in one piece must be decided. Whatever else is done, designs should be checked to be sure that it is possible to make the mold parts.

Another item for the designer's consideration is the steel to be used for the various mold parts. Past experience has gone far toward narrowing the field of suitable materials. Today there are only a few special steels which are being used. For hobbed mold cavities, a special grade of carbon-chrome-silicon steel is required for the hard, tough master or hob that is pushed into the equally special SAE 3110 hobbing steel.

SAE 3312 steel is used for machined parts of molds, both compression and injection. This steel, as well as the SAE 3110 hobbing steel, must be case-hardened after the parts have been finished to their final form in order to provide the necessary surface-hardness and strength. In the case-hardening furnace a case of 0.040 to 0.050 in. is applied to the mold parts and to test pieces which subsequently will be broken to check depth. Small mold pins are made of music wire, while larger pins are made of drill rod.

It should be noted that the SAE numbers given above are merely indications of the basic formulations of the steel used for molds. The steel manufacturers have done considerable work on improving the processing of these special steels and, as a result, the toolmaker has been given materials with better machinabilty, greater strength, better hardening properties, and more freedom from inclusions. Our plastics department employs a metallurgist who spends his time trying to find materials and methods for molds.

Molds are an indispensable part of the plastics industry. Such molds, if poorly designed, can be a source of endless annoyance and loss to the molder. Properly designed molds will give high production over a long service life. A good background of practical experience in all of the phases of the plastics molding business is one of the greatest assets of a mold designer.

Limiting Age of Trainees

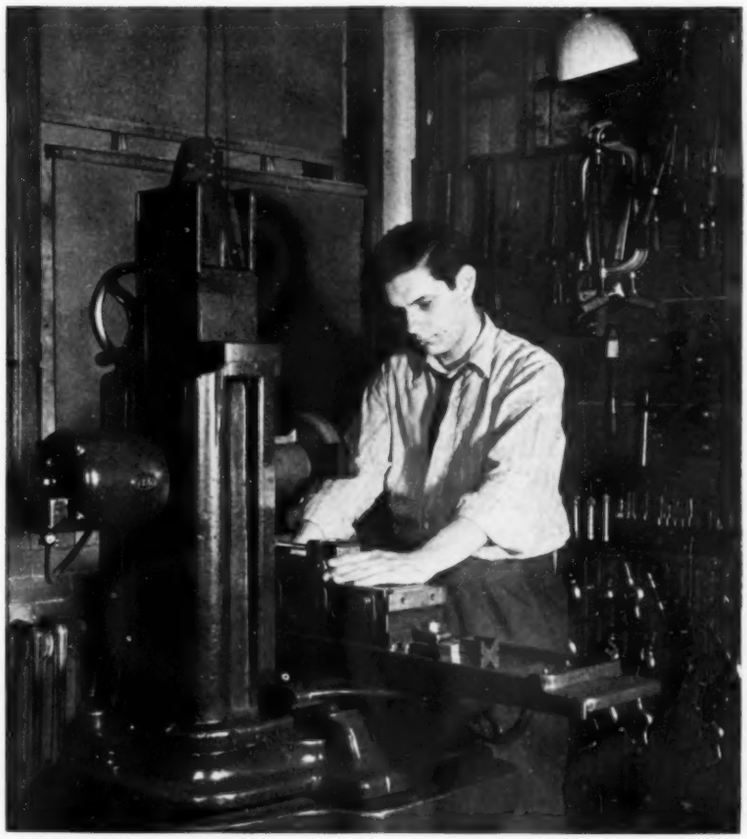
MANY SHOP TRAINING courses limit the minimum age of applicants to 21 years. In some cases it is younger, frequently 18. In view of the shortage of trained men and the likelihood of greater demand, it might be wise to modify some of our ideas on this subject.

There may be cases where men over 21 can afford to start work at apprentice wages. If they can—and want to—it is difficult to see why they should not have an apportunity to become skilled mechanics.

Shops which maintain training courses for operators, or for men to become skilled in the operation of one or more special machines, do not find age a barrier. "Old dogs can learn new tricks," and many become skilled in one or more lines. They usually have a greater feeling of responsibility, because of age and previous experience, than very young men.

A case in mind is a young man of 34 who has worked in machine shops and apparently has decided mechanical leanings. He wants to be a thorough all 'round machinist but is barred from all apprentice training courses that he has contacted so far. He is willing to start at apprentice rates of pay, and would probably learn much more rapidly than the average apprentice because of his shop experience. The chances are that he would be a first class machinist of value to almost any shop.

Helping schools help industry



A local boy works at the Sidney High School on equipment donated by a local company. The first weeks of bewilderment in a manufacturing shop are thus avoided

BY WENDELL W. WHIPP, PRESIDENT, MONARCH MACHINE TOOL COMPANY

Industrial training must be brought down to earth if it is to be effective. The sooner we start thinking in terms of local needs, the sooner will Shop X in Town Y get results

INDUSTRY needs more trained men. Except in the very depths of depression there never have been enough properly trained men in American industry to meet current needs. Whenever business has emerged from a slump and started uphill, there has always been a scramble to secure such trained men as were available. Only when the supply became smaller than the demand has business set seriously about training new ones.

A few industries have developed thorough apprenticeship training and learners' training programs. But apprenticeship programs account for only a small percentage of the total number of men to be trained, and are designed chiefly for men expected later to arrive at supervisory positions. Learners' programs, as put into practice, are often admittedly short-term, limited affairs designed to meet an immediate emergency.

There has been a hope that some sort of a cooperative plan, or organization, might be set up and operated by the industries within a community for the training of men for industrial occupations. But to all intents and purposes, this is a theory.

When vocational education began to develop some years ago, there was a tendency upon the part of a good many industrialists to feel that the schools could largely take over the job of training men. While schools did prove of immense value in providing young men with groundwork for industrial jobs, it was soon learned that no amount of education could take the place of actual training in the shop.

By and large, this whole picture falls into no particular pattern. It is simply a general hodgepodge. There has not been developed any major formula, any one broad practical method, for training men.

What does this mean? Does it mean that in this particular field industry has fallen down? Does it mean that the schools have fallen down? I don't think so for a minute.

I think that the schools have been doing a marvelous job, considering the rather passive attitude which industry has shown toward them. They have, in fact, gone about the job in the only practical way in which it can be done—by the companies in each community tackling their training problems in the light of their own particular circumstances.

The kaleidoscope which today's training picture presents is to my mind proof positive that the training of men is not a blanket proposition. It is something which companies and communities can and must undertake on the basis of their own needs and facilities.

The moment the subject is approached from this point of view, it ceases to become a complicated national problem. It becomes instead a specific local problem, sufficiently definite and concrete to be capable of solution.

For instance—Mr. Jones, president

of the ABC Company, might be able to contribute little to a national symposium upon the subject of employee training. But as to his own plant, he knows that right now he needs seventeen machinists. He would like to have at least six boys starting in his plant each year on an apprenticeship training basis; and he wishes that the young fellows applying for jobs had a little more practical knowledge about his particular business and the kind of machines which they are expected to operate.

That is much the situation which confronted the industries of our small town of Sidney, Ohio, and we have worked out what for us at least has been a practical solution.

In the first place, we felt that we would not have to go outside of Sidney for our new men—even in view of a substantial expansion in business. This meant that we would probably take into our employ every year a number of the boys from Sidney schools.

Obviously each company could work out for itself, in whatever way seemed most practical for its own requirements, apprentice training courses or learners' or other training programs for the boys to tackle as soon as they got into the shop. The factor which worried us was the educational one.

Our boys, particularly our high school graduates in Sidney, had just as good a vocational education as graduates of similar schools in other cities—but they didn't know enough about Sidney industries, and about the machines to be operated in Sidney plants.

Equipment Supplied Gratis

It seemed to us that our high school might be interested in having facilities which would enable them to teach the boys at least some of the rudimentary principles of the kind of work which is done in the various factories in Sidney. From that point on, it was simply a matter of working out details.

Under the Smith-Hughes law, the schools could obtain from the federal and state governments a grant of half of the salaries of teachers needed for vocational training. The stumbling block in the past had been the cost of equipment, the cost of supplies and materials, and the cost of power and maintenance.

The industries of Sidney agreed to supply the machines and materials. Lathes, drill presses, planers, shapers, metal-melting furnaces, heat-treating furnaces, hand tools for the machinist trade, steel bars, sheets, bolts and screws were contributed. The increased expense to the school system, therefore, was confined largely to the cost of power and maintenance.

In most communities, school training courses comparable to those in Sidney would be absolutely impossible without the cooperation of the industries of the community. The school simply could not afford to pay for the equipment and materials required. Where this is attempted by school funds alone, it often happens that equipment is so limited and materials so few and inferior that the "training" is little better than theory and provides no real preparation for actual shop practice.

Boys Get Advance Training

As to results—this is what the Sidney High School training program means to our own company. Because the boys who come to us from our high school have already operated machine tools and learned something about them, our company in our training program, can skip right over those first few days or weeks of complete bewilderment which are inevitable and which have to be paid for when boys come into a plant without any previous familairity with the type of machine used in that plant. In short, those boys can go to work immediately on a productive basis.

The school authorities in Sidney are just as pleased as are Sidney's industries with the co-operative plan which we have in effect.

It not only gives them equipment and tools to go with—it enables them to do a really vocational job. It helps them to give their boys the kind of training which is keyed into the employment needs of their own city.

Why can't an arrangement like this one be extended, at least experimentally, to hundreds of other communities?

This plan is founded upon two very simple premises—the school fits its training courses to the industries in its own community, and the industries in the community provide the school with proper training equipment and materials.

Note that this sort of cooperative arrangement is not one designed to help merely the apprentice training men—the small percentage who are chosen as candidates for future supervisory positions. This program follows the broad principle of educating the young men in a community to be able to take their places in the industries which support that community.

Naturally a method of this sort is much simpler in a city which has one major industry than in a city which has a variety of industries. It is simpler perhaps in a small town than it is in a large city. And yet it is not impossible in a large city.

In Denver, Colorado, there is operated, as a part of the city's regular school system, the Emily Griffith Opportunity School. This vocational school is open not only to high school students but to adults, and the courses given and number of pupils having them are coordinated with the industries and the employment opportunities in Denver.

Williamsport, Pa.—a city of about 50,000—has organized a school to train adult workers to fill the particular requirements of local industries. This is a community enterprise—cooperating agencies include the Y.M.C.A., the Y.W.C.A., the N.Y.A., the W.P.A., the local trade association, the Catholic parochial schools, the county school system, the local Civil Service Boards, and the various industries having plants in Williamsport. It was recently reported that about 3,000 people are enrolled in this school and last year some 600 of the "pupils" got jobs in Williamsport's industries.

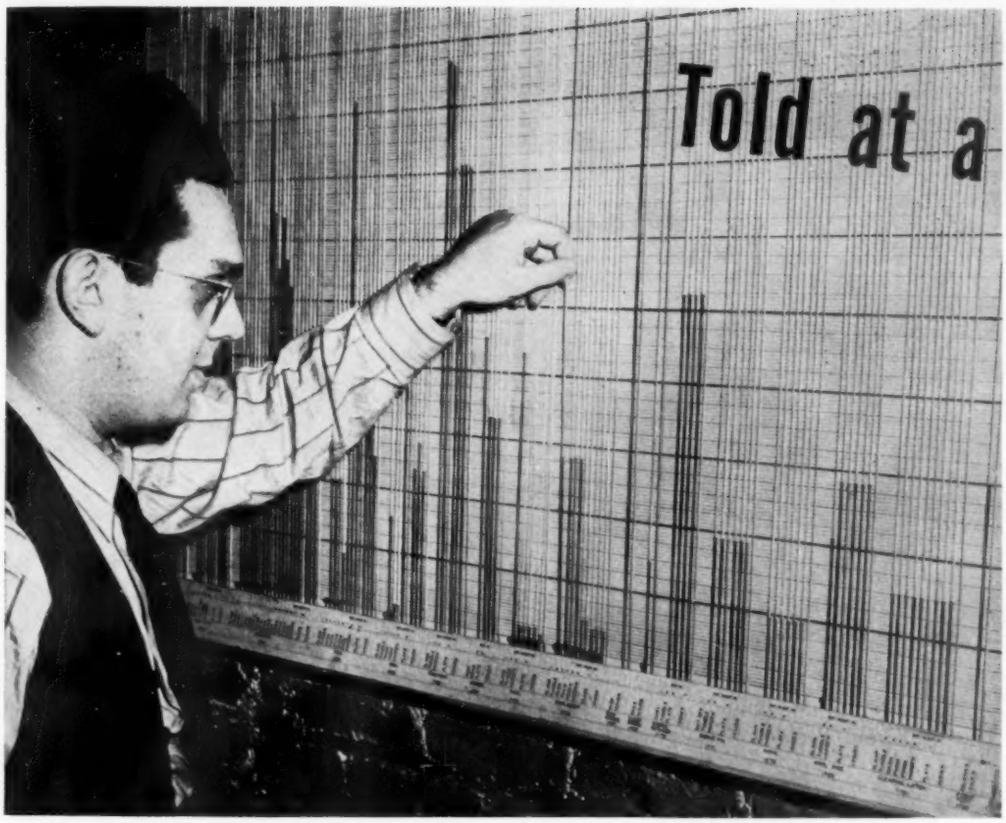
If for some reason a community enterprise is not practicable, it seems to me that the individual company would do well to try to work out with school officials some method whereby, if the company would provide machines, equipment and supplies for training purposes, preliminary training would be taught by the use of that equipment. The result would be a potential supply of youngsters who would be, to say the least, three or four weeks ahead of other applicants.

Misfits Eliminated

One of the most important functions which the presence of actual equipment in school training courses accomplishes is that of helping to weed out the misfits. Many a boy who thinks he would like to be a machine tool operator may change his mind after actually attempting to operate a machine tool. Every employer knows how costly this weeding out process is when it has to be done after high school boys have come into the plant.

Thus, our schools can be of enormous help to us—if they have the right equipment. The machines do not have to be the latest or best models. Basic principles of machine operation can be taught on a machine still capable of fair work but too old for today's rigid requirements.

Told at a glance



Quick adjustment of a colored string to correspond with work done keeps this control chart up-to-date. The status of any batch of parts, whether inside the plant or at an outside shop, is revealed at a glance

KEEPING TRACK of thousands of small parts as they progress through various shop operations is a problem often solved by complicated, cumbersome systems which often seem more trouble than they're worth. Speed Products Co., paper fastening equipment maker, has worked out a solution which combines simplicity, economy, convenience and speed.

Devised by S. A. Crosby, chief engineer, it consists of a unique adaptation of the commonly used flow-chart principle, in the form of a bar-chart control board in which the bars are lengths of colored cord readily adjusted to keep pace with production.

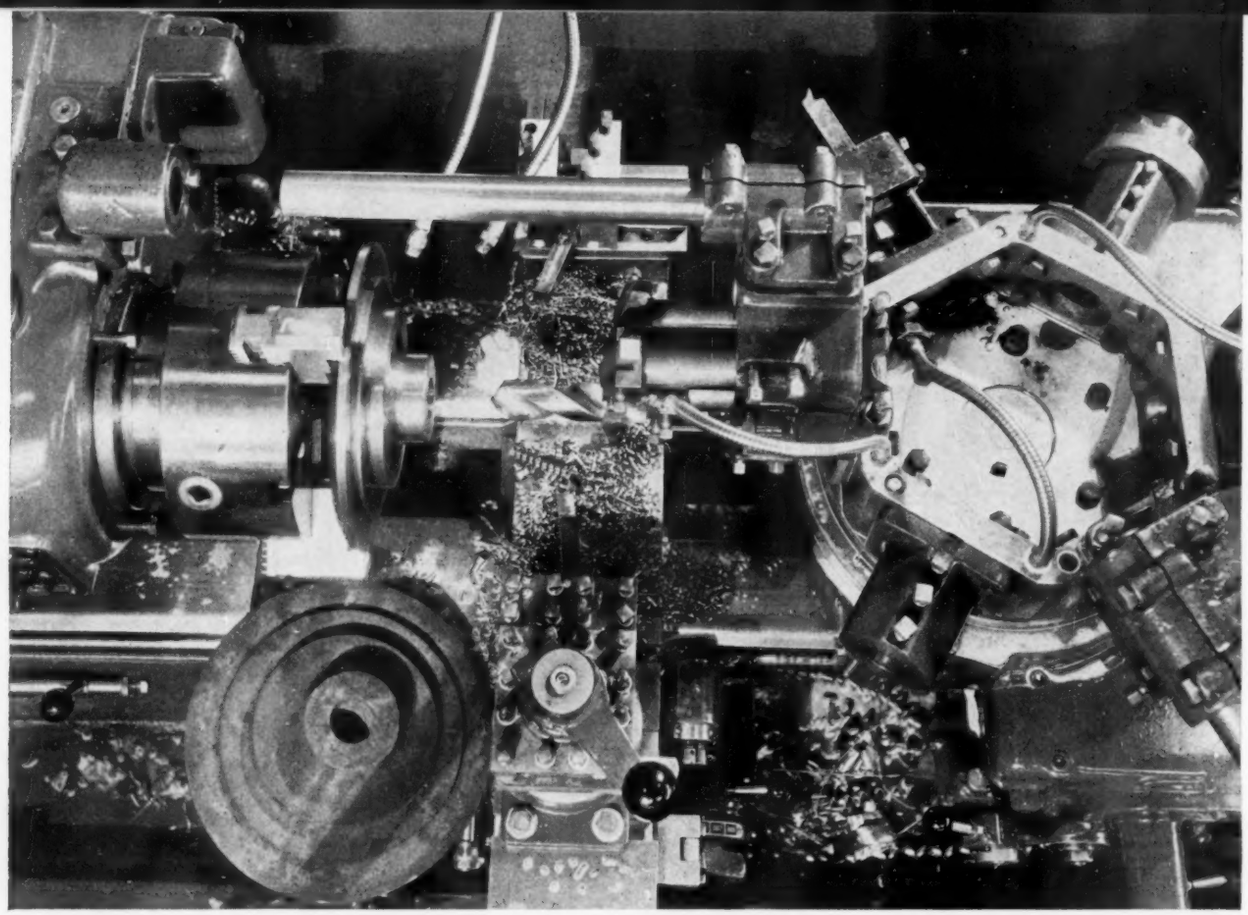
The board itself is constructed of a plywood backing onto which are glued sheets of drawing paper. Along the top and bottom edges of the plywood are nailed half-round wood moldings having a diameter somewhat greater than the thickness of the plywood. Over these moldings pass vertical loops of waxed string, properly spaced by nails driven into the moldings. Each loop is made of two lengths of cord, one white and the other colored, tied tightly enough to hold the loop snugly on the moldings at the top and bottom.

The chart proper is laid out with its vertical scale representing number of parts, heavy horizontal lines being ruled for every 10,000 units, with lighter lines in between. The base is composed of sections for the individual parts, each section being divided into columns for every operation required by that particular piece. For parts purchased ready for use from outside suppliers, there are columns marked "received" and "issued." In the case of parts sent outside for hardening or finishing, there are also columns marked "out" and "in." In each case there is a column marked "issued." Every column has its corresponding string.

When production starts, all strings are set so that the joint between the white and colored portions comes at the bottom, or zero line, leaving only white string showing. At the end of the first day's production, each string is raised so that its colored portion indicates the number of parts which have passed through the operation it represents. Day after day the same procedure is followed, the colored string climbing like mercury in a thermometer. When one operation is completed on the total number of parts in the lot, the colored string is raised to the top of the chart, showing that this operation is finished and that the parts are ready for the next operation, which is similarly indicated. Thus at any time a glance at the chart shows the exact status of any batch of parts.

When all operations on a given part are completed, the chart so indicates and the parts are sent to a stock room. If they are sent outside for further operations, the "out" column shows exactly how many have been sent and the "in" how many have been returned. When a sufficient number of each part required is in stock and assembly is to begin, the necessary requisitions are issued and the number of parts issued by the stock room to the assembly department is indicated in the "issued" column of the board.

Posting can be made as often as desired from tickets filed by the foreman or stock clerk. Foremen, superintendent and others can consult the chart as a guide to what has been accomplished and to what should be scheduled to bring low parts up to the level required to keep machines busy and production moving in step with assembly. The chart also keeps purchasing, production and stock departments informed and enables them to plan their work in a systematic manner, and permits management to follow progress of work through the plant and see that assembled units will be ready to meet delivery date.



Widely different diameters are machined simultaneously by using carbide tipped tools on the larger diameters and high-speed steel tools on the smaller diameters. Two diameters are turned while the hole is drilled

What tools for turning?

BY D. W. MELLOR, JONES & LAMSON MACHINE COMPANY

High-speed steels and sintered carbides each have their place in turning, boring and facing operations. They often can be used together advantageously

ALL OF THE FACTORS involved in a particular metal-cutting operation are interdependent. The choice of cutting tools is only a part of the equation for which the solution is the most profitable way to perform a certain operation on a certain part. So much has been written about the relative merits of various cutting tool materials that in many cases the main issue has been lost in the controversy and the cart planted solidly in front of the horse. This is particularly true with turret and single-spindle automatic lathe operations.

Hard alloy cutting tools and high-speed steel cutting tools each have their place, and it is not difficult to extol the merits of one or the other in specific cases. To make a comparison on general terms is both dangerous and misleading. The efficiency of these materials is dependent upon the use to which they are put and, perhaps most of all, upon the machine in which they are used. This machine must be capable of using the cutting materials to their maximum advantage, it must be capable of giving the hard surface speeds required, and it must be able to transmit the power for cuts taken at these speeds without sacrificing accuracy.

For many years we have experimented with hard alloy cutting tools, in fact we first worked with them back in 1926 when some early specimens of these tools were brought over to us from Europe. Today we machine some 1,800 small lot jobs using hard alloy cutting tools. Many more such jobs could be machined in the same manner, but other methods are employed to reduce cutting time on these jobs. It is hardly necessary to use special tools on a turret lathe to save ten or fifteen minutes on a shaft or spindle that can be machined in three minutes with multiple tooling on an automatic lathe.

Naturally, the quantity must be sufficient to warrant the use of an automatic lathe, but there are numerous instances where lots of spindles as small as five or ten machined on automatic lathes with high-speed steel tools show a saving of 30 per cent or more over the same operation on a turret lathe. Multiple tooling does not necessarily require the use of an automatic lathe. Turret lathes equipped with a bridge type carriage and cross slide provide opportunities for multiple tooling and

combined cuts which may reduce cutting time 75 per cent or more.

Logically then, where work can be performed on either automatic lathes or turret lathes, the first consideration is the choice of the machine. This generally is a simple comparison of the total estimated lot production time.

The question of tooling then arises. This is a more complex problem, involving several factors. First, perhaps, is the relation of cutting time to total lot production time, since the choice of cutting tools affects cutting time only. Shall hard alloy tools be used, or will multiple tooling or combined cuts, or both, with high speed steel cutting tools, serve as well or better?

In some cases cutting time is almost eliminated as a factor in the choice of tools by the nature of the material being machined. In cases such as the machining of cast iron, brass, bronze, aluminum, and similar materials where the abrasive qualities of the material make tool life a predominant factor, hard alloy tools are unquestionably superior. On small lots they can be stored and used again with just a little touching up, and on large lots tool grinding is reduced to a minimum. On most steel jobs, however, cutting time is a primary factor and generally will decide the kind of tooling and the type of tools to be used.

Many of the turret lathes in our plant are of an older type that have served their purpose well. However, with the advent of fast cutting hard alloy tools, and with the demand for faster, more accurate production, a more versatile machine was needed. Accordingly, during the past few years we have revolutionized our turret lathe design. We have provided a wider range of spindle speeds, improved the rigidity of the machines, and improved the ease of handling. In order to make a thorough test of these new lathes under production conditions we inaugurated a special turret lathe department to do general lathe work. This deaprtment now is an important and profitable factor in our production.

All types of parts, from small lots of studs, pins and screws that could not be machined economically on automatics, to parts made from castings or forgings weighing 60 lb. or more, are machined in this department. High-speed steel and hard alloy cutting tools are used to advantage after a careful study of their possible application and the alternatives in each case has been made.

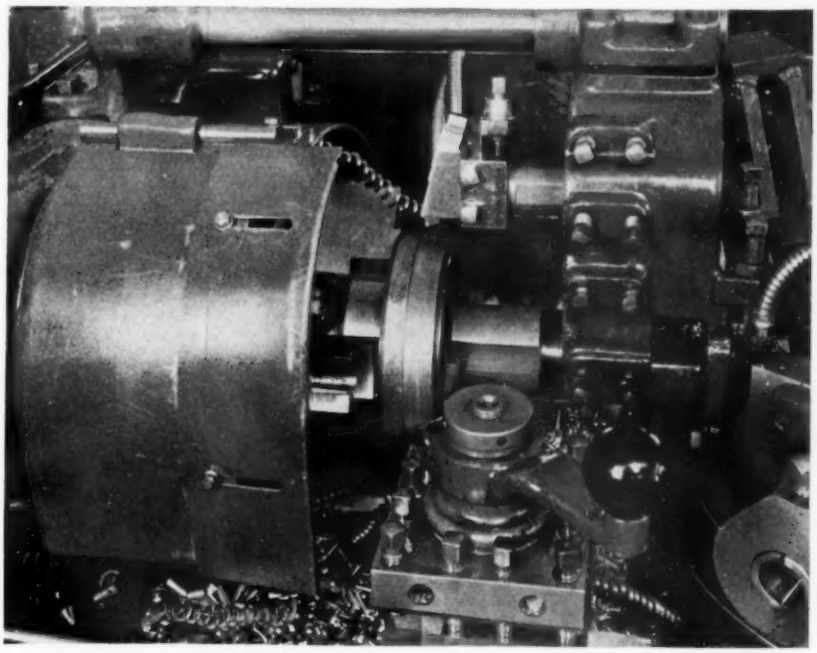
Sometimes it has been found that by multiple tooling on the front and rear of the cross slide, as many as nine tools have been mounted this way, cutting time has been reduced to a relatively negligible item and high-speed steel tools are adequate for the job. Obviously, if a very small lot is to be machined, a simple, quick set up, with hard alloy cutting tools is more advantageous. Again, when very close limits are to be held and the cut must be interrupted frequently to gage the work, carbide tipped tools cannot be used to advantage. On thin or fragile work, distortion due to heat or to pressure of chuck jaws may require extra gaging or extra handling time, which will still further reduce the relative importance of cutting time, or make high surface speeds impractical.

Fast cutting hard alloy tools have been used to great advantage. They may be used exclusively on a single job, or in combination with high-speed steel tools. Their use with high-speed steel tools does not appear to have had the attention that their exclusive use has received.

For example, in many cases, it would not be practical to combine cuts on different diameters if high-speed steel tools were used alone. The lower spindle speed required by the larger diameter would entail longer cutting time than if the two diameters were machined separately. But with a carbide tipped tool to machine the larger diameter and a high-speed steel tool to machine the smaller, maximum surface speeds can be run on the smaller diameter without increasing the surface speeds on the other diameters beyond the capacity of the carbide tipped tools.

Materials such as cast iron, bronze, brass, aluminum and other nonferrous metals, because of their abrasive effect on high-speed steel cutting tools, make the use of hard alloy cutting tools obligatory if the maximum surface speed allowed by these materials is used. The machine must be capable of using these tools; high spindle speeds, rigidity and power transmission, far in excess of those required when high-speed steel tools are used, must be available to use hard alloy cutting tools to their maximum advantage when cutting metals.

Tool life, in general, is another important factor in the selection of cutting tools. This factor is very difficult to gage. Much depends upon the operator, and much upon the nature of the job and the material. Under certain conditions, hard alloy tools need less service per pound of metal removed than do high-speed steel tools. Each case merits individual study. In the final analysis, method, machine and tools combine to achieve economy of operation, not the tools alone.



Frequently tools at the front and the rear of the cross slide can be used while tools mounted on the hexagon turret are cutting. In this operation, a tool mounted on the rear of the cross slide faces, while two tools in a multiple turning head of the turret bore and turn

Fabricating the flying fortress

Huge steel jigs make possible mass-output economies for the limited lots of subassemblies in the world's best bomber

MORE ENCOMIUMS have been heaped upon the broad wings of Boeing's Flying Fortress than on any other American military plane. Praised publicly as the world's safest airplane, it has also been widely heralded as the deadliest weapon in the history of warfare. It has set astonishing speed records across the North American continent, and has won heart-warming ovations during good-will flights to South America. Substantial new orders for the ship have caused redoubled activity in Boeing Aircraft Company's Seattle plant, where production has been stepped up to one plane every four days.

Making the Flying Fortresses involves problems rare in other branches of the metal-working industry, problems only recently solved by aircraft production experts themselves. One of the most trying is the handling of unwieldy, delicate subassemblies, which must be kept in precise alignment until each has become an integral part of the plane structure. Outstanding among these units are the various wing sections and the fuselage. These are assembled in huge jigs made of structural steel shapes welded together to form rigid frames. Built into each jig is an elaborate network of scaffolding to enable workmen to work on several levels at the same time.

Handling the completed assemblies in the crowded plant is a problem all its own. The units are large and cumbersome, and obviously can't be banged around like locomotive castings. Fortunately, their weight is comparatively slight, and an ingenious overhead monorail system has proved to be highly satisfactory. In this system the crane trolley, including the operator's cage, moves the width of the bay hanging from two rails, the rail structure in turn being free to run the length of the bay, suspended by half a dozen rails fastened to the roof trusses. Thus any spot within the bay may be serviced, without sacrificing valuable headroom and without building heavy structural work, which would be necessary to provide for a crane span of almost 200 ft.

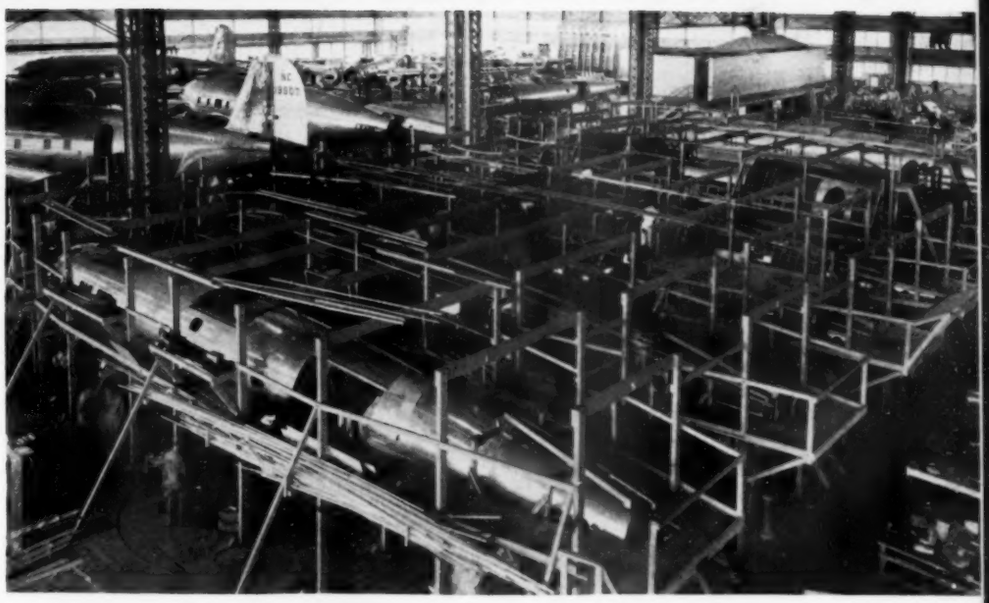
Wing sections are assembled on edge in huge welded-steel jigs, top. Permanent scaffolding enables men to work on several levels of both sides at once. Special fixtures facilitate handling by a monorail crane hanging from roof trusses. Below, landing gear is installed as sections progress down the bay

THE SHIP ITSELF

The Flying Fortress is a high-flying, fast-moving, long-range weapon claimed to be capable of reaching out to any conceivable enemy base, of carrying enough explosives to cripple any ship afloat or wreck any type of ground fort or gun emplacement, and of defending itself successfully against attack launched by current pursuit ships.

It has injected a new element into the field of aerial warfare, and has bred a whole new category of military aircraft. Though its general design is not unlike that of earlier ships, its merit lies in an all-round stepping up of practically all the characteristics of a military plane: greater size, greater speed, greater range, greater load-carrying ability, greater high-altitude performance, greater ability to defend itself.

Powered with four 1,000-hp. air-cooled radial engines, the Flying Fortress is an all-metal mid-wing monoplane with fully retractable landing gear. Turrets are provided around the fuselage at the sides, top and bottom, so that machine guns can be trained on a ship attacking from almost any direction. It has a wingspread of 103 ft. 9 in., a length of 67 ft. 10 in., and a gross weight of 45,470 lb. Its service ceiling (altitude at which rate of climb has fallen to 100 ft. per min.) with full load is 30,000 ft., considerably above the effective range of anti-aircraft guns. Its top speed is 268 m.p.h. Models now under construction are expected materially to exceed these performance figures.



Surrounded by wood scaffolding, the steel jigs shown above insure accuracy in fuselage assembly. As each fuselage nears completion it is carried to the final assembly line, where wings, tail surfaces and other subassemblies are fitted in position. All production lines for subassemblies feed into this assembly bay. Below, finishing touches are applied. Production is one complete plane every four days

Bombs by the ton can be released when the bomb bays of the substratosphere Boeing Flying Fortress are swung open

More about stripping

BY JOSEPH I. KARASH, RELIANCE ELECTRIC & ENGINEERING COMPANY

When should knock-out pins be used? What designs permit the punch and stripper to be ground at the same time? The author gives practical hints on these and other design points

KNOCK-OUT PINS provide a method of stripping which has advantages from the standpoint of low die maintenance cost. Shown in Fig. 11 is an example of knock-out pin stripping which has a number of applications. The die is shown in both the open and shut positions so that the action of the pins can be better visualized. It should be noted that on the down-stroke of the ram, the stripper plate is in a retracted position. As the punch pierces the material, the blank is forced down through the die block and the outer piece is forced up onto the punch. Near the top of the upstroke the knockout pins come in contact with the stationary knock-out bar. As the ram continues to rise, the pins force the stripper plate down and thus strip the work from the punch.

Since the material is stripped at the top of the ram stroke, this type of die should be used only when the material is to be punched but once. Should an attempt be made to use this die for punching a series of blanks from strip stock, the scrap would travel up to the top of the ram stroke and make the handling of the material an extremely awkward operation.

Stripping the material from the top of the ram stroke is not always a disadvantage. On the contrary, it can be made to be an asset if the die set is used in an inclined punch press. The tilt of the press will cause the material stripped at the top of the ram stroke to fall clear of the die, thus saving the operator the necessity of placing his hands into the die set to remove the scrap.

Fig. 12 shows a design of punch holder identical to that shown in Figs. 9 and 10 (*AM*—Vol. 84, page 466) except that a hole has been drilled through the shank for a knock-out pin. This makes the die flexible in the sense that the pin stripping action can be used for unit stock inclinable press operation, or spring or rubber strippers can be inserted so that the die can be used for punching a series of blanks in strip stock. When using the knock-out pins, the material automatically would be ejected from the inclinable press. When using an inserted spring or rubber stripper, the material would be left lying on the face of the die block.

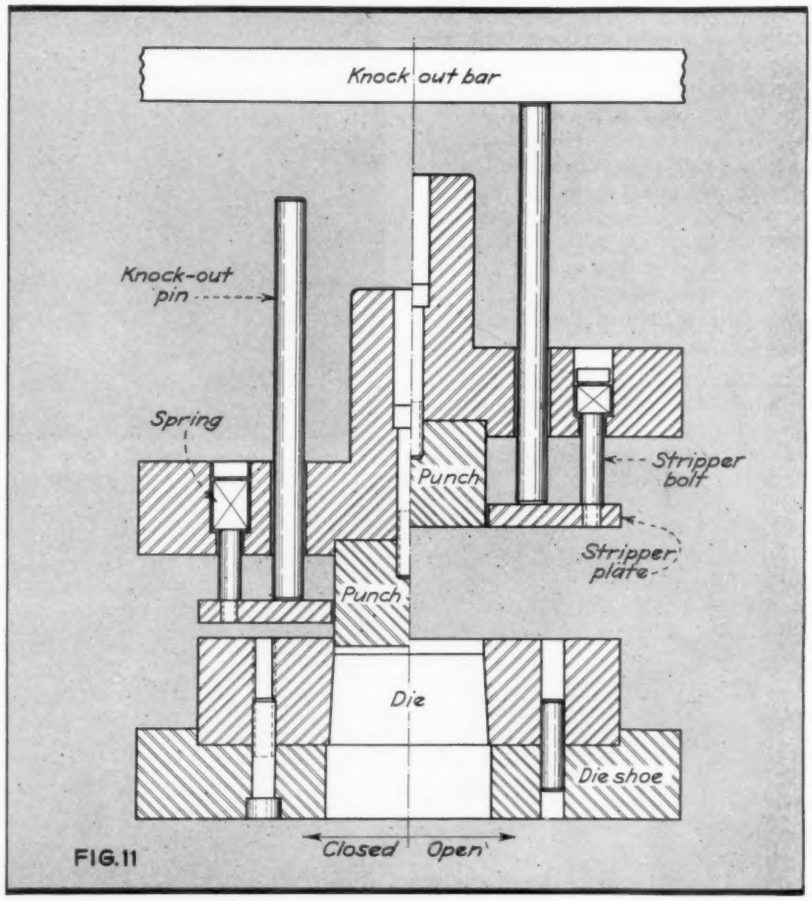


Fig. 11—Knock-out pins have definite advantages from the stand-point of die maintenance cost, and are particularly useful for single punchings made in inclinable presses

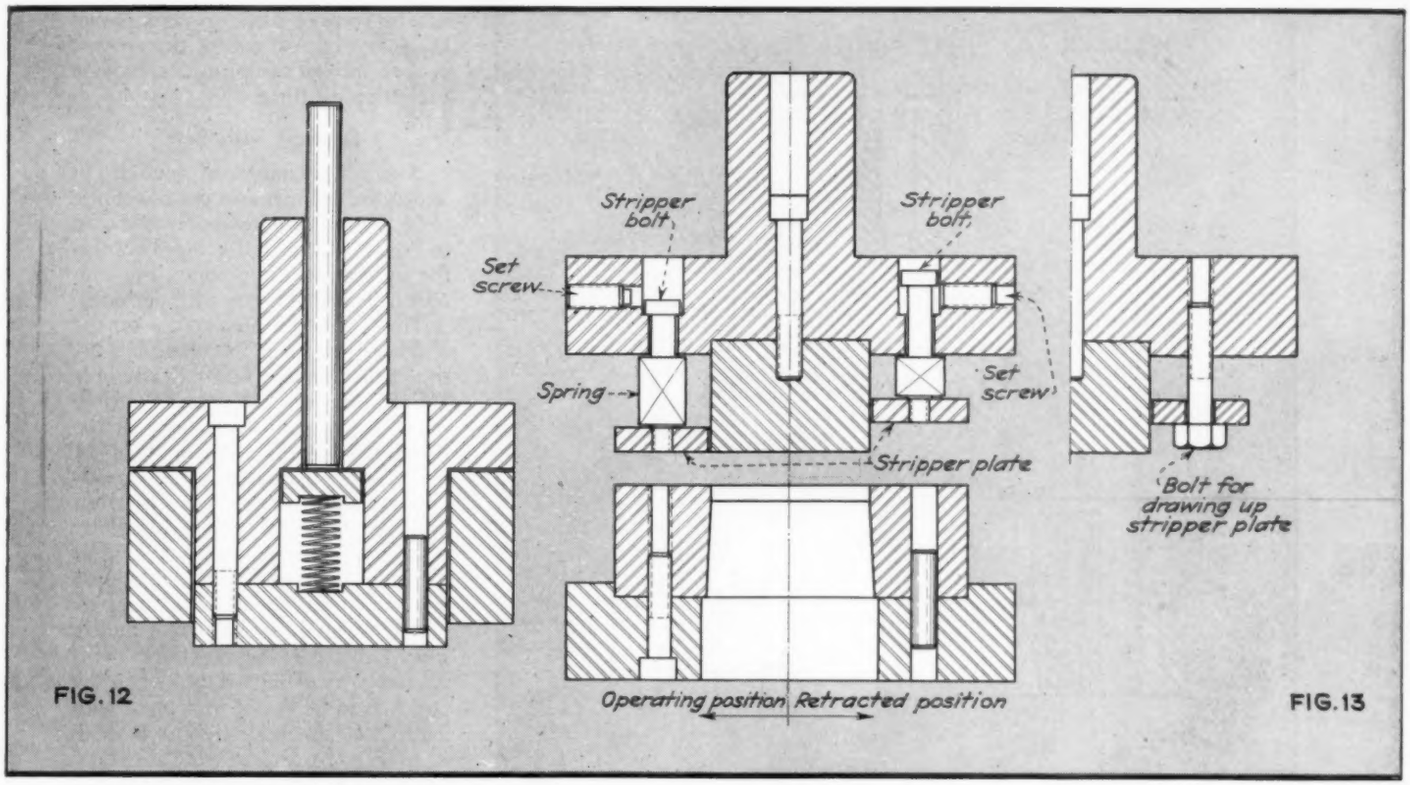


Fig. 12—This punch holder is drilled for a knock-out pin, making a flexible arrangement which can be used for unit operation in an inclinable press, or with a spring for punching a series of blanks. Fig. 13—Set-screws are used to hold the stripper plate in a retracted position so that punch and die can be engaged for setting up in the punch press without guide posts

The inherent advantages of the use of knock-out pins from a die maintenance viewpoint are:

1. No dismantling, reassembly or adjustment of the stripping mechanism is required in conjunction with the grinding operation, due to the fact that the stripper plate normally is in a retracted position.

2. Knock-out pins do not prevent the punch from entering the die, and consequently do not in themselves necessitate guide posts for setting up.

Stripper Plate Locking

In designing dies it sometimes is desirable to produce a spring-operated stripper plate die which can be set up without guide posts. A simple method of accomplishing this is shown in Fig. 13. The design is a spring operated stripper plate type except that tapped holes are provided in the punch holder so that the heads of the dog-point set screws can be entered under the stripper bolts in order to lock the plate in a retracted position. At *A* in Fig. 13 is shown the provision for forcing back the stripper plate to allow the set screw to get under the stripper bolt heads. With the stripper plate in a retracted position, the punch and die can be engaged, and the die-set set up without guide posts.

After the die set has been secured into position in the press, the ram adjustment screw is run down until the die has been compressed enough to take the stripper bolt heads off the dog point screws. The set screws then can be backed away to clear the stripper bolts. The ram adjustment screw is then raised and the die set is in operating position.

Before removing the set from the press, the set screws can be locked into place again by compressing the stripper plate with the ram adjustment screw. The die set can then be stored with the stripper plate in a retracted position. One of the elements of die maintenance cost which can be affected by design is the labor involved in the sharpening operation. This labor element usually is the greatest in the cases where the stripping mechanism must be dismantled, reassembled and adjusted to compensate for wear every time the die is ground. Should the die be so designed that it is unnecessary ever to dismantle or adjust the stripping mechanism, it readily can be seen that savings will have been achieved in die maintenance.

A design principal which can be used to accomplish this objective is to construct the die set so that both the stripper and the punch can be ground down during the sharpening operation. This always will keep the stripper flush with the cutting edge of the punch, thus eliminating all dismantling and adjustment during the life of the die.

An example of this type of design is shown in Fig. 14. The stripping is accomplished by a sleeve backed up by stripper springs. Both the sleeve and the punch have sholuders machined on them to act as stops. Length from the shoulder to the end of the sleeve should be held to a maximum dimension so that the life of the punch will not be limited by the stripping device.

Since the edge of the stripper is flush with the end of the punch, the stripper springs must be preloaded. This is accomplished during the original assembly operation by the screw which secures the punch.

Guide posts should be used in conjunction with a design of this type to facilitate setting up. If no guide posts are used, the set-up will be difficult because the stripper prevents the punch and die from engaging. A

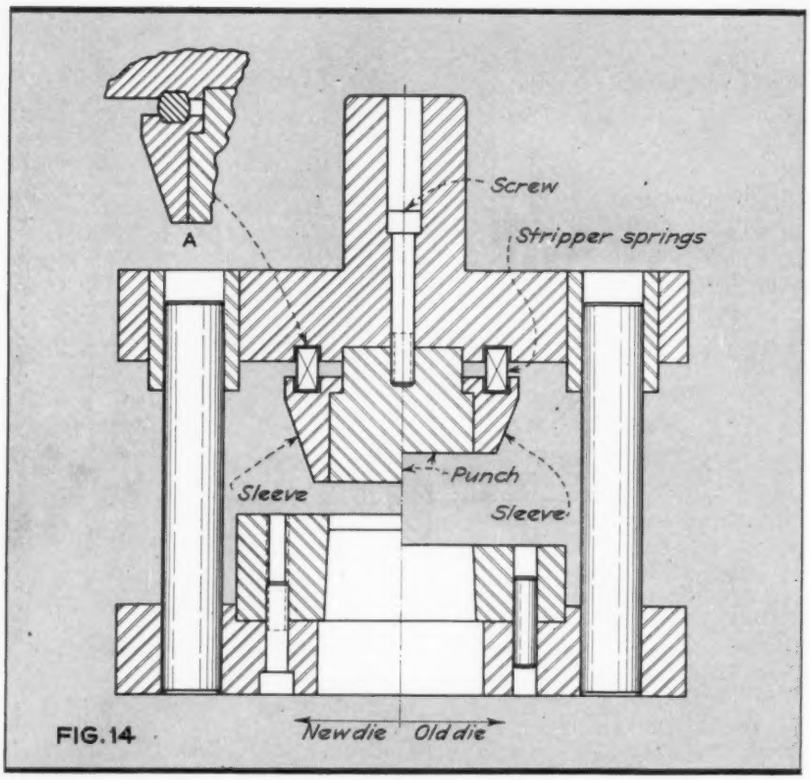


Fig. 14—Dismantling and readjustment of punch and stripper plate is accomplished by designing them so that both may be ground at the same time

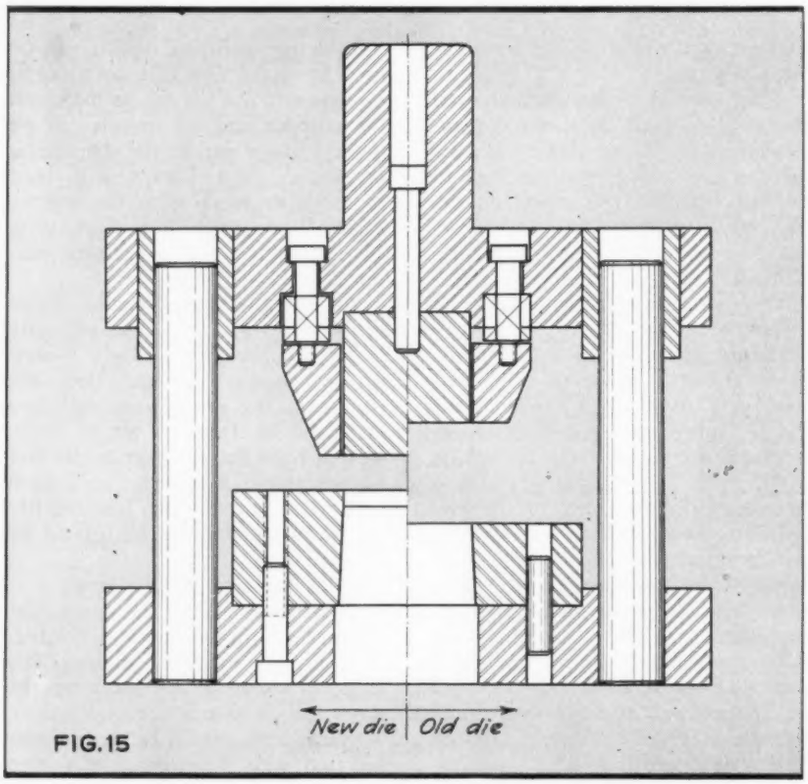


Fig. 15—This design combines the advantages of simultaneous grinding of punch and stripper with the possibility of dismantling the stripper without removing the punch

similar form of piercing die is shown at *A* in Fig. 14, except that rubber is used instead of springs to provide the stripping force.

Support with Bolts

Another example of design in which the stripper and the punch are to be ground simultaneously is shown in Fig. 15. Instead of using shoulders for supporting the stripper, the support is provided by the stripper bolts.

The necessary preloading of the stripper springs in this design is accomplished in the original assembly by drawing up the sleeve until it comes home against the body of the stripper bolts. The springs can be preloaded to the length of the threads on the stripper bolts. To all practical purposes this should be sufficient.

An incidental advantage of this type of design is that the stripping mechanism can be dismantled and replaced without removing the punch, should this ever be necessary. This advantage is of importance when the punch is to be sealed into place with matrix. If shoulder support is used, as in Fig. 14, the punch sleeve and springs must be assembled at the same time, and it would not be practical to use matrix because the stripper sleeve and springs would interfere.

Part 4 of Mr. Karash's series will appear in an early number.

This Firm Practices What It Preaches

"For fifteen years it's paid us to practice what we preach," insists Crompton & Knowles Loom Works, Worcester, Mass. Preachings:

"Maintain a cash depreciation fund to keep production machinery modernized.

"Each year replace at least ten per cent of your least efficient equipment.

"In setting the annual sum to be added to your depreciation fund, be guided by conservative accounting practice, even though the amount is too high to be allowed for income tax purposes.

"Don't make the depreciation fund a 'paper account.' Have it in the form of ready cash or the equivalent—liquid, ready to use.

"Don't base your depreciation charges on original costs, second-hand markets, or appraisers' valuations. Use the current cost of the newest, most modern equipment—of what you need, not of what you have."

Flame machining

BY J. G. MAGRATH, AIR REDUCTION COMPANY

II—Gouging by means of the oxyacetylene torch has many uses and is a time saver as compared to other methods

A GROWING DEMAND is being experienced for a fast, economical method of removing defective welds disclosed by the X-ray or gamma ray. The chipping hammer, a slow method at best, fails to meet increasing production requirements. The oxactylene flame machining process for flame gouging, used for many years for gouging out defects in steel stocks in the steel mill, and in the foundry and forge shop, is rapidly being accepted as an economical means of meeting production and cutting costs.

Where light weight plate, $\frac{1}{2}$ and $\frac{5}{8}$ in. thickness can be laid out in large areas, with their edges butted and tack welded, the process serves for manual gouging the necessary full U-groove in the abutting edges. After welding, the joined plates are turned over and the root of the weld is then manual gouged preparatory for welding.

A number of applications for this process have proved satisfactory:

Removal of tack welds; defective welds; roots of welds; defects in steel castings, forgings, plate, etc. Removal of welds from temporary brackets; holders; lifting plates; flanges from pipe; heads from boilers. Removal of scale congested tubes from boiler heads and manual grooving for plate-edge preparation.

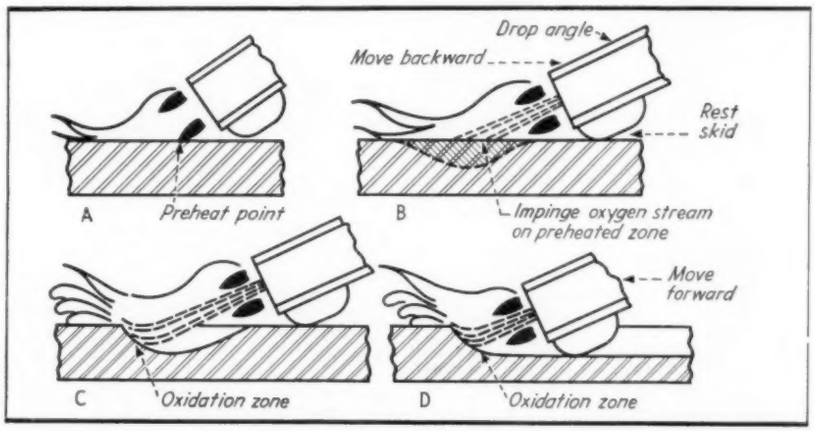


Fig. 10—For manual progressive gouging the tip takes the positions illustrated in these side views

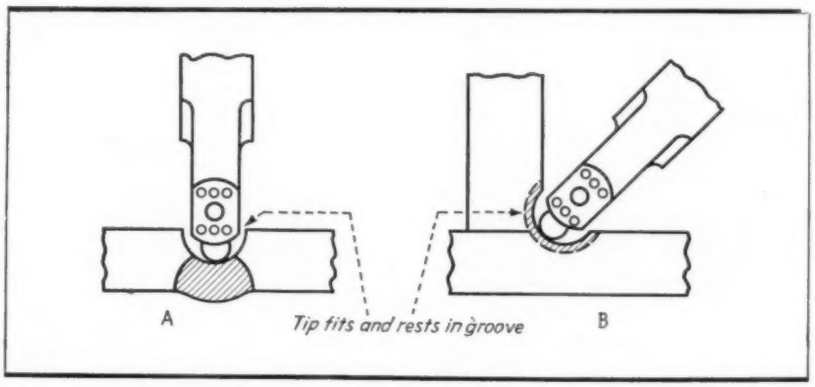


Fig. 11—Flat sides of the tip makes it possible to enter deep grooves

All steels as hereinbefore mentioned as being flame machinable for plate-edge preparation (*AM*—Vol. 84, page 456), may be flame gouged, observing the same precautions.

The use of the oxyacetylene torch for these applications offers a number of distinctive advantages over mechanical chipping of welds and grooves, including:

Speed—The process proceeds at a forward speed of 1 to 3 linear ft. per min.

Accuracy—With acquired correct technique, a tolerance of $\frac{1}{16}$ in. on width and depth can be maintained.

Quiet—A feature of all oxyacetylene process. Din and vibration are absent.

Portability—The light-weight apparatus provides for quick set-ups in shop, yard or field.

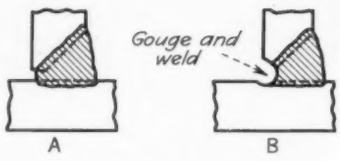
Economy—Its speed saves operating time. There are no tools to be repeatedly reconditioned.

Control—Operated on low oxygen pressures, providing low velocity oxygen flow, which allows control of direction in guiding path of gouge or groove.

Flexibility—Ability to operate in ordinary inaccessible spaces.

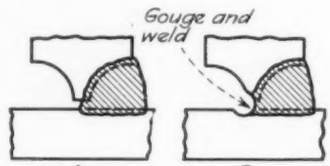
Oxyacteylene flame gouging employs standard cutting torches and supplementary oxyactylene apparatus. For manual gouging a hand cutting torch with either a 90, 75, or 45 deg. head, as preferred by operator, is used. With correct technique, a gouge or groove of predetermined contour and dimension is made in the metal, without completely penetrating through the work, as in severing with flame cutting. Different sized tips, working pressures, degree of angle and technique provide for variation in shape, width and depth of gouge or groove.

Width of gouge is primarily a matter of tip size. Several different available size tips allow for gouge widths of $\frac{5}{16}$ to $\frac{9}{16}$ in. Tips for making gouges of less or greater widths can be had on order. Depth of gouge is a matter of angle of impingement primarily and oxygen pressure and forward speed secondarily. To deepen the gouge, the



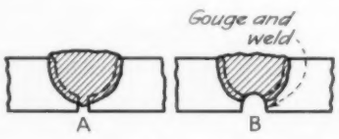
Gouging root of single bevel

FIG.12



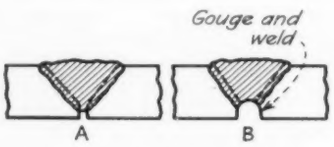
Gouging root of double J

FIG.15



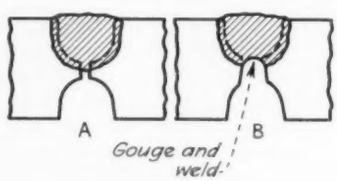
Gouging root of U groove butt joint (light plate)

FIG.18



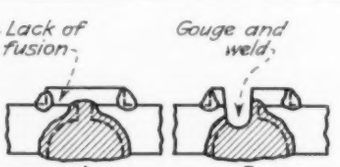
Gouging root of single V butt joint

FIG.19



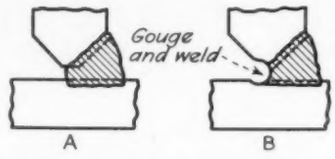
Gouging root of double U groove butt joint (medium plate)

FIG. 22



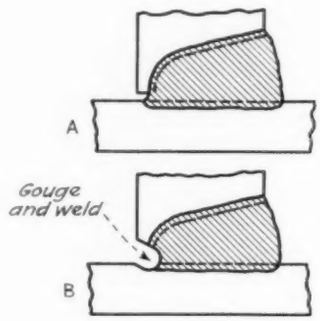
Gouging defects beneath permanent back-up strip

FIG. 25



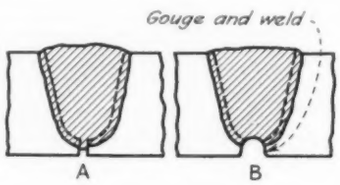
Gouging root of double bevel

FIG.13



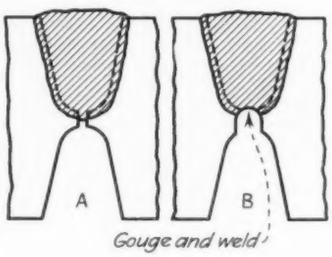
Gouging root of single J (heavy plate)

FIG.16



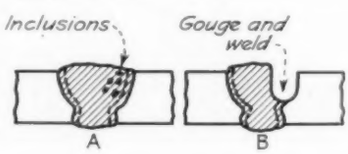
Gouging root of U groove butt joint (heavy plate)

FIG. 20



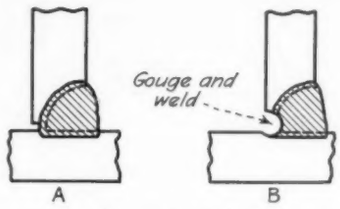
Gouging root of double U groove butt joint (heavy plate)

FIG. 23



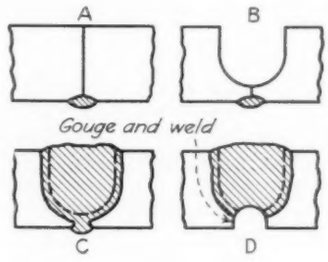
Gouging out foreign inclusions

FIG.26



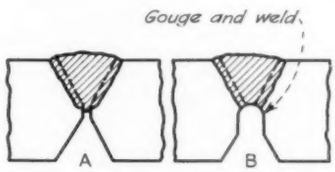
Gouging root of single J (light plate)

FIG.14



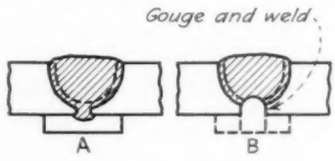
Gouging both sides of tack welded butt joint (light plate)

FIG.17



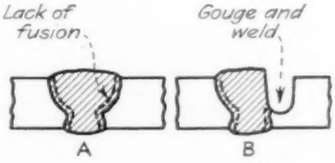
Gouging root of double V butt joint

FIG.21



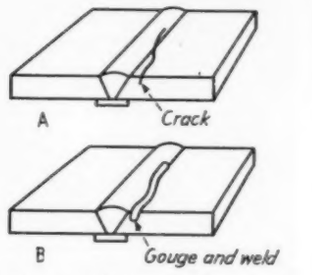
Gouging off temporary back-up strip

FIG. 24



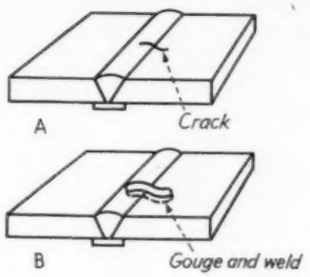
Gouging out unfused areas

FIG. 27



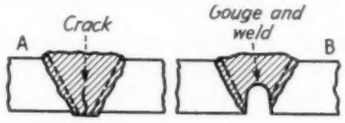
Gouging out longitudinal cracks

FIG. 28



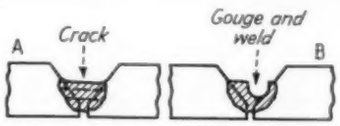
Gouging out transverse cracks

FIG. 29



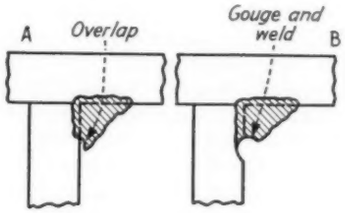
Gouging out root cracks

FIG. 30



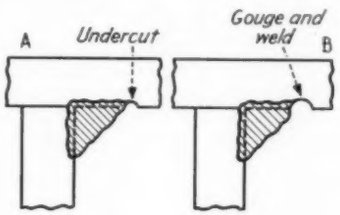
Gouging out longitudinal layer crack

FIG. 31



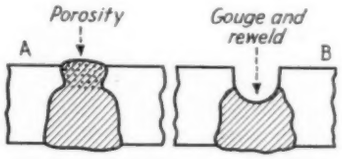
Gouging out overlaps

FIG. 32



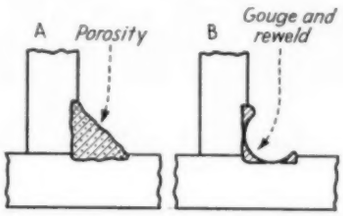
Gouging out undercuts

FIG. 33



Gouging out completely imperfect butt welds

FIG. 34



Gouging out completely imperfect fillet welds

FIG. 35

angle of impingement and oxygen pressure is increased and the forward speed reduced. To reduce the depth, providing a shallow gouge, the angle of impingement and oxygen pressure is decreased and the forward speed is accelerated.

The condition of the resulting edges with respect to cleanliness, smoothness and sharpness is a matter of manual skill and proper regulation of the impingement angle, oxygen pressure and speed. Insufficient oxygen pressures and speed may result in a rippled bottom surface. Higher pressures than those required, may cause the loss of the cut.

In the removal of completely defective welds, the roots of welds, backing-up strips and manual grooving for U-grooves on edge butted plates or for special conditions, the manual progressive method is employed. A tip of the proper size to give the required width is chosen and pressures adjusted to provide the proper depth. The tip head is held at an angle of 30 to 45 deg. to the horizontal or vertical plane of the surface, allowing the inner preheat flames to touch the surface to allow for preheating. See Fig. 10*A*. When the surface reaches the kindling temperature, the angle between the tip and the surface is reduced to between 15 and 20 deg., and simultaneously, the tip is drawn backward for a distance of $\frac{1}{4}$ to $\frac{1}{2}$ in. and the oxygen is gradually released to impinge upon the preheated zone, as shown in Fig. 10*B*.

As soon as oxidation of the metal occurs, Fig. 10*C*, the forward motion is started. See Fig. 10*D*. Sufficient speed is maintained to keep the slag puddle ahead of the reaction zone and to hold the cut. The hard-faced steel skid on the bottom of the tip head provides for maintaining the correct elevation of the flames from the surface and prevents the tip sticking in the groove. The flat sides of the tip allows for entering in deep grooves and corners, as shown in Fig. 11*A* and *B*. If the direction of the weld or groove is other than a straight line, the gouging may follow such path by gradually swinging the tip in the horizontal plane in the direction required, the same as one would with a chipping hammer. During this procedure, the angle of the flame impingement must remain constant.

Defective Welds Removed

Defective welds of short length, defects beneath backing up strips, deep defects in steel castings, forgings and plate are removed in much the same procedure as is employed in deseaming. In manual spot gouging, however, it is desirable to have as narrow a gouge as possible to reduce the amount of welding necessary, and of sufficient depth to fully remove the defect for its full depth to sound metal. Therefore, a steeper angle of flame impingement is employed. Seams and other defects will be discernible as dark streaks or areas against the red of the molten zone.

The gouging tip finds its greatest use in the removal of roots of welds. This is a manual operation which, with the mechanical chipping hammer is slow and difficult, but which, with the oxyacetylene flame, is quietly accomplished in less than half the time.

The removal of welds roots from single and double bevel, single and double V, and single and double J- and U-groove joints is shown in Figs. 12 to 16 and 18 to 23 inclusive.

When light or medium weight plates are laid out in large areas, butted edge to edge and tack welded, the welding groove can be manual

Fig. 36—Two ½-in. plates are butted together and tack welded before gouging

Fig. 37—Plates are reversed and a U-groove is gouged along the joint opposite the tack weld

Fig. 38—After gouging, the plates are arc-welded in the U-groove path produced by the touch

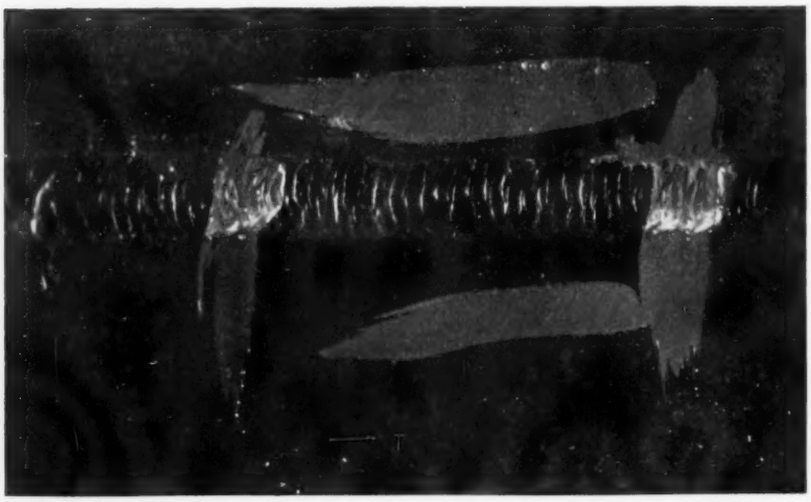


Fig. 39—A section of the weld is marked for removal by the inspector because of the disclosure of a defect by X-ray

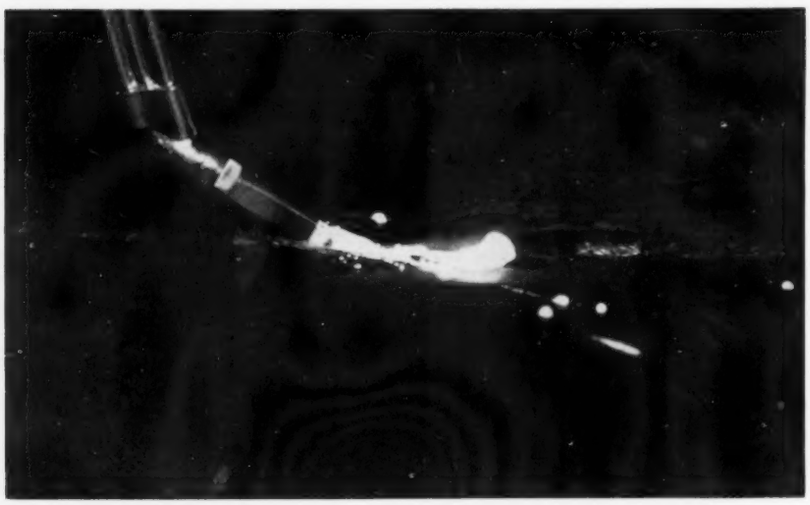


Fig. 40—Defective areas are readily removed by oxyacetylene gouging after they have been discovered by visual inspection or X-ray

gouged throughout as illustrated in Fig. 17. The sides opposite to the tack-welds receive a manual oxyacetylene U-grooving as deep as practical for good construction, and then welded. The roots of these welds, on the underside, are then removed, with the tack welds, and the edges are welded flush.

Photographic examples of this procedure are given in Figs. 36 to 38 inclusive. In Fig. 36 two plates, with edges butted, are shown tack-welded together. Fig. 37 shows a U-groove being manually gouged, along the joint, on the opposite side. A straightedge is used to aid in guiding the torch in a straight line. Note how the slag puddle moves ahead of the torch leaving the gouge reasonably clean. The U-groove is being welded in Fig. 38.

Temporary back-up strips may be removed and the root of the weld cleaned up as illustrated in Fig. 24. When the X-ray reveals defects beneath permanent back-up strips, as shown in Fig. 25, such may be removed as detailed and the gouged area welded flush with the face of the strip.

Defects in welds, such as inclusions, lack of fusion, porosity, longitudinal and transverse cracks, root and layer cracks, overlaps and undercuts are removed as illustrated in Fig. 26 to 35 inclusive.

This operation is further illustrated in the photographs Fig. 39 and 40. A weld is shown, Fig. 39, as marked by the inspector for sectional removal. This is one of a series in which the X-ray has disclosed defects beneath the surface. In Fig. 40 the oxyacetylene flame is removing the defective area.

For faster run-in

Running in valuable machinery can be a nerve-racking task. Colloidal graphite added to oil helps do the job more safely

NOT SO LONG AGO many a mechanic kept a bar of Sapolio handy for rubbing on a bearing when it had to be run in. Others favored putting a handful of flake graphite or mica into the oil. These rough-and-ready ingredients tended to prevent galling or seizing because they furnished some lubrication even if the oil film broke down under the high pressures.

Today lubricating oils for running in machinery may incorporate extreme-pressure properties provided by the soap and by minute particles of graphite suspended in a liquid.

By definition an extreme-pressure material is one which will unite chemically with metals. Two such materials commonly used are chlorine and sulphur. Either will form an oxide layer at the metal surface, thus keeping the bearing surfaces apart.

Graphite is not an extreme-pressure material as generally defined, but its property of becoming closely bonded to the surface of metals gives a lasting lubricating quality because it cannot be squeezed out although the carrier itself may be. It has the additional advantage that it can be mixed with any good lubricating oil.

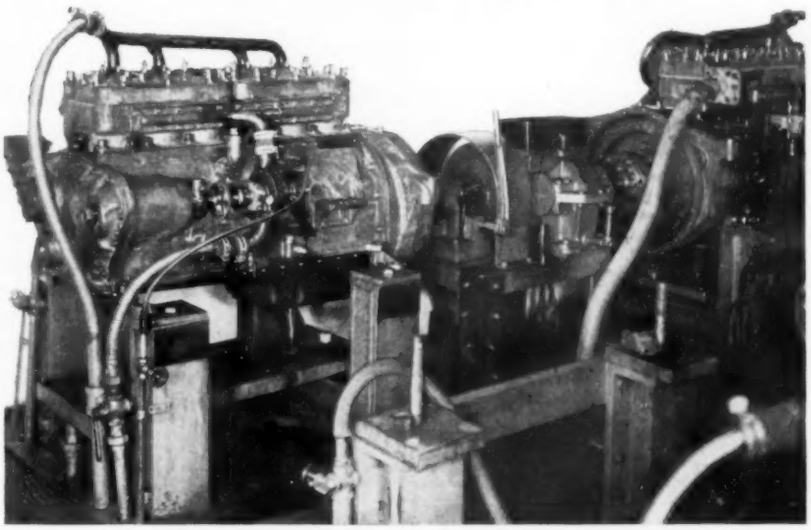
To turn an assembly of heterogeneous parts into a smoothly operating machine requires a certain amount of wearing in, so that adjacent moving surfaces work well together. Before it is usable, a newly assembled engine, machine tool, gear box or any other assembly with bearing surfaces may require hours of running in under light loads, with seizing and galling an ever-present hazard.

With proper precautions, regular good grades of lubricating oil can be used successfully for running in many types of machinery. At the same time, constituents may be added to keep the parts clean and avoid gummy deposits which otherwise might have to be removed before shipping the machine. If lightly loaded and if temperatures are carefully watched, no difficulty will be experienced with regular lubricating oils. Their chief disadvantage is the necessity for stopping the machine to permit it to cool down before continuing the running in. Engine manufacturers have solved this problem by connecting individual lubricating oil systems to a central oil-circulating arrangement.

If a reduction in total running in time is desired, the portion due to shut-down for cooling can be reduced by the use of oil containing extreme-pressure materials or colloidal graphite. Because of its ability to suspend readily in many types of carriers, colloidal graphite has been found particularly useful in this field. Its tendency to settle into the pores of the metal provides lubrication even if the oil film is broken down.

This same manufacturer has also successfully used oil with colloidal graphite for running in a large diameter cast-iron bearing. Four per cent colloidal graphite was mixed with a lubricating oil and was found to be a sufficient amount to slow down the rate of temperature rise. Reduction in cooling-off time with the specially prepared lubricant was found to give an over-all saving of 30 or 40 per cent of running-in time.

In general the amount of colloidal graphite to be added to the lubricating oil or other carrier will vary from 0.2 to 0.7 per cent. Automotive engines are being run in at lower percentages, while machine tools may use



A green six-cylinder engine is run in by one already limbered up, after which it is run under its own power. Clean oil is delivered from a centrifuging plant to the engine through a flexible tube

One machine tool manufacturer had a problem of running in gear boxes which would have been expensive to rebuild if seizing or galling took place during the operation. A close watch had to be kept on the running temperature when ordinary lubricating oils were being used during run-in. Even then the temperature rise was so rapid that there was always the possibility of ruining the gear box before it could be stopped. By using a good grade of lubricating oil with colloidal graphite, the critical temperature was reached much more slowly, with consequent improvement in temperature control. Equivalent results were achieved with good lubricants having sulphur or chlorine.

quantities up to the higher amounts.

The use of colloidal graphite with oil or some other carrier achieves other advantages also. Several manufacturers are pre-coating parts which are to be assembled later. This insures that machinery will not be started without, at least, a certain amount of lubrication present. Some of the airlines are using oil with colloidal graphite to prepare their engines for running-in after being repaired.

In no case should these materials be considered a substitute for good machining practices. Considerable trouble has been experienced because machine shops have tried to rectify inaccurate machining by using a specially treated oil or graphite.

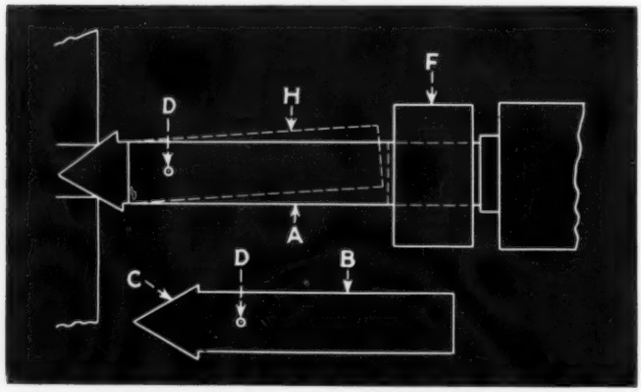
IDEAS FROM PRACTICAL MEN

Testing Alignment of Tailstock Spindles

By H. MOORE
Leeds, England

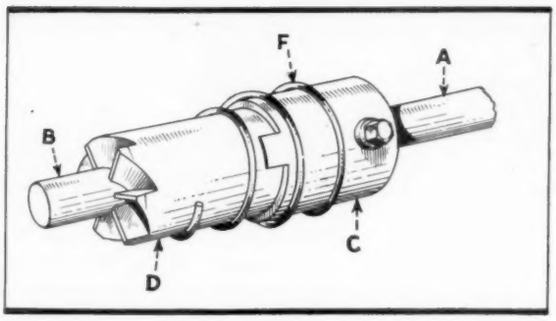
In reaming in the lathe the tailstock and headstock spindles must be in accurate alignment with each other, otherwise the hole in the work will be bell-mouthed.

Illustrated is a simple device for testing the alignment of the two spindles. Essentially it consists of the slotted bar *A*, one end of which is tapered to fit the tailstock spindle; the piece of flat steel *B* having an arrow head at *C* and fitting in the slot in bar *A* to which it is pivoted at *D*; and the collar *F* which is a snug sliding fit on the bar. With the device in place, the bar is advanced by screwing out the tailstock spindle until the arrow head of piece *B* is in firm contact with the metal at the mouth of the hole to be reamed. If the tailstock spindle is out of alignment with the live spindle, the arrow head will not be centered in the hole and piece *B* will swing on its pivot and its tail will project beyond the surface of the bar, as indicated by the dotted lines *H*. In that condition collar *F* can not be slid along the bar toward the headstock because the projecting tail of piece *B* will interfere with its passage. The collar is supplied only as a convenience, to check the position of bar *B*.



Alignment of the tailstock spindle with the live spindle can be tested with this simple device. Unless the spindles are in accurate alignment the collar can not be slid along the bar

To align the tailstock spindle with the live spindle, the tailstock must be adjusted so that when the arrow head of piece *B* is in contact with the metal at the mouth of the hole its tail is flush with the surface of the bar and will not interfere with sliding the collar along it when checking the alignment.



This counterbore can be used in places where a solid one would interfere with some part of the work. It is convenient for shops where such tools are used infrequently

Counterbore for Inaccessible Work

By MARTIN H. BALL

A counterbore of the type illustrated can be used in otherwise inaccessible places where the larger and shorter shank of a solid one would interfere with an overhanging wall in the work, or where it becomes necessary to pass the bare shank through a hole above the hole to be counterbored and then assemble the various parts to the shank. It is convenient for use in sizes that may not be in stock, as is the case in many shops where counterbores are not frequently used and are not stocked in proportion to other small tools.

The counterbore shank *A* is made of drill rod; pilot *B* is an integral part of the shank. The driving head *C* is attached to the shank by two quartering setscrews bearing on spots in the shank and has a tongue on each side of the bore on its lower end to engage a slot in the upper end of the cutter *D*. The friction spring *F* prevents the cutter from falling off the shank in handling and in seating it on the work.

Cutters of various diameters can be used and the pilot can either be reduced in diameter or can have a bushing placed on it to suit holes of different diameters. Where the job will warrant the extra outlay, a shank having a taper can be made, giving better driving power and reducing the cutting time.

Preventing Blow Holes in Built-Up Pistons

By A. H. CARROLL

The railroad welder is a prolific "builder-upper." About 60 per cent of his work is rebuilding worn parts back to a size that permits machining to finished dimensions. For example, piston heads are seldom changed when they become worn; a long-wearing bronze is usually welded to the bottom or worn part of

the head or bull-ring. No difficulty is entailed in doing this, providing a few simple precautions are taken.

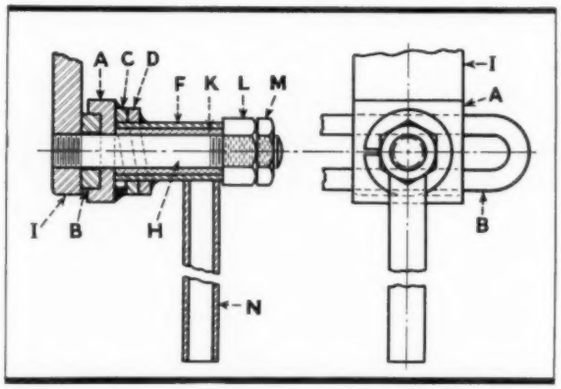
Some piston heads are porous in nature and the metal soaks up a great deal of oil. When the welder attempts to braze this piston he finds that regardless of the care he takes in applying his bronze the metal will be full of blow holes. This is caused by the eruption of the gas pockets made and liberated by the heat of the torch. To prevent this, heat the area to be brazed to a dull red and allow it to cool. Since this surface does not tin readily it is a good idea to grind the spot heated with a portable grinder.

Quick-Acting Locking Device

By R. L. AUSTIN

The device illustrated is for securely locking a hinged machine vise at any desired angle of inclination. Its advantages are that no wrench is necessary to operate it, its clamping action is quicker than could be effected by a stud and nut having threads of standard pitch, and it can be assembled from a few pieces that are readily obtainable in almost any toolroom or machine shop.

The device consists of the sliding member *A* which rides on the slotted bar *B*; the lockwashers *C* and *D*, both of which have had the "bighting" edges ground off and one of which is welded to the sliding member



Lock washers welded to opposing members, one of which can be rotated, serve as side-acting cams and lock the joint of a machine vise together when the lever is rotated

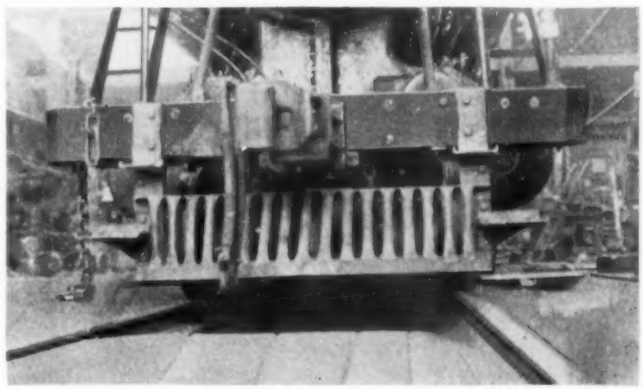
A, while the other is welded to the short piece of $\frac{3}{4}$-in. pipe *F*; the stud *H* screwed into bar *I*; the brass bushing *K*; the nut *L*; the locknut *M*; and the lever *N* welded to the short piece of $\frac{3}{4}$-in. pipe.

In operation, when the lever is rotated it rotates the short piece of $\frac{3}{4}$-in. pipe on the brass-bushed stud and carries with it lock washer *D*. Since the lock washers are in the form of a helix, one riding on the other acts as a cam and clamps the sliding member and the bars together, thus securely locking the joint and preventing the vise from moving. About a 25-deg. rotation of the lever is sufficient to lock or unlock the joint of the machine vise.

Scrap Boiler Tubes Make Good Locomotive Pilots

By ARTHUR HAVENS

Rigid and good-looking locomotive pilots can be made from scrap boiler flues and angle irons. A welder can make the entire pilot, bending his own angles for the nosepiece, top angles and back braces. Sections of scrap flues form the vertical pilot spacers.



Rigid locomotive pilots can be welded complete from scrap angle irons and boiler tubes. Shearing the tubes to length, flattens them sufficiently for welding between the top angle and the pilot nose

When the scrap flues are cut to length in the shears, they are flattened just enough for welding. These are cut in pairs of equal length, with a slight bevel if necessary at the lower end to fit the angle iron which forms the pilot nosepiece.

Boiler plate can be flame cut and used with suitable braces at the ends of the pilot to form the steps. They are then riveted to the end members. Such pilots are made in standard sizes to be interchangeable for locomotives of different types. Obviously, this eliminates the use of numerous jigs and fixtures in the fabrication and maintenance of the pilots.

Spring Tension Varied Automatically

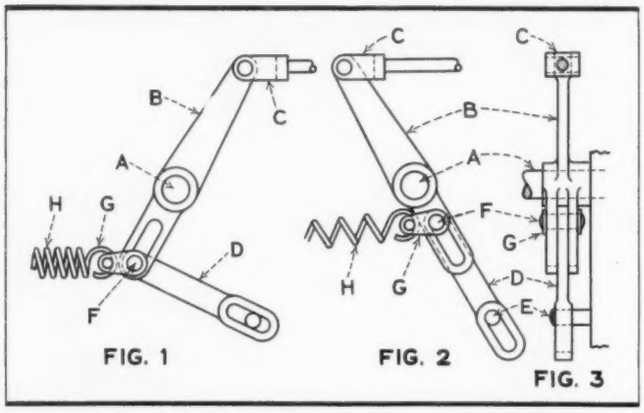
By L. KASPER

On a wire-forming machine, a shaft was to be given an irregular oscillating motion from an open or external cam, a spring being used to maintain contact of the cam follower with the cam. Some difficulty was encountered with the operation of the machine due to the fact that a light spring failed to maintain contact of the follower on the low points of the cam, whereas a heavy spring proved too severe in passing over the high points of the cam. The sketches show how the spring tension was controlled.

Referring to Fig. 1, the rod *C* received its motion from a distant cam, transmitting it to the shaft *A* through the lever *B*. Lever *B* is forked and slotted at its lower end to receive the pin *F* in the slot and the link *D* in the fork. Link *D* is slotted at its lower end to slide on the pin *E* attached to a stationary part of the machine. The yoke *G* serves as a fastening

point for the spring *H*, which acts through lever *B* to maintain contact between the cam and its follower.

In Fig. 1, the cam follower is at the low point of the cam and the tension of spring *H* is lowest. As the rod *C* is moved to the left by the cam, the forked end of lever *B* swings to the right, the increase in spring tension being directly produced by the increase in the length of spring *H*. The movement of lever *B* causes the link *D* to slide downward on the pin *E*. As the pin *E* contacts the upper end of the slot in link *D*, the latter is restrained from further downward movement, and oscillates on pin *E* as a center. The oscillation of link *D* produced by continued movement of lever *B* causes pin *F* to rise in the slot in the forked end of lever *B*, until at the high point of the cam the position of the pin *F* is as shown in Fig. 2. A comparison with Fig. 1, indicates that the effective



Where a spring is used to maintain contact between a cam and cam follower, this arrangement of levers vary the spring tension and enables the cam follower to maintain uniform contact at all points on the cam

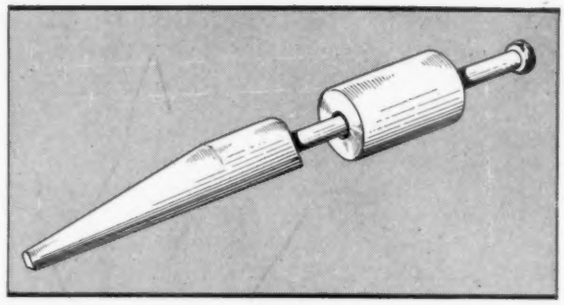
length of the arm of lever *B* has been considerably reduced, thereby resulting in a relative reduction in the pressure of the cam follower on the cam at its high point. In other words, although the tension of spring *H* is considerably greater in Fig. 2 than in Fig. 1, the resistance to the movement of the rod *C* is considerably less than if pin *F* and yoke *G* had remained in fixed position relative to the center of shaft *A*.

The purpose of the slot in the lower end of link *D* is to permit some initial build-up of spring tension, and also to permit some adjustment in the length of the rod *C*. Fig. 3 is an end view of the assembly.

A Handy Key for Knocking Out Taper-Shank Drills

By H. E. HAGEMAN

The key for knocking out taper-shank drills and sleeves from spindles frequently does not enter the tang slot deep enough to stay in place without being held. This makes it necessary for the machine operator to use one hand to hold the key while the other wields a hammer, leaving the drill point to fall where it may.



This combined key and hammer is a handy tool for knocking out taper-shank drills and sleeves from machine spindles

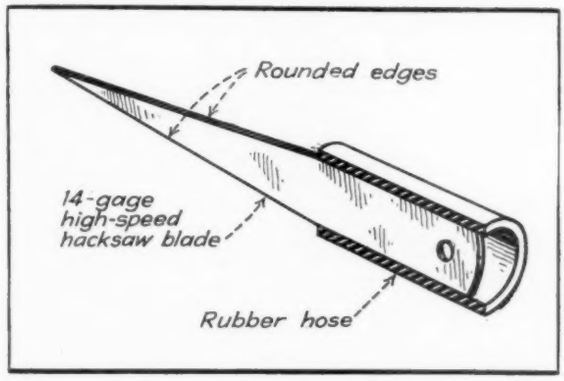
It probably was with this thought in mind as well as that it saves reaching for a hammer that the combined key and hammer here described was devised. The dimensions given are for use with No. 4 Morse shanks.

This device is simply a key of standard shape forged with a shank about $\frac{1}{2}$ in. diameter and 7 in. long on which is loosely mounted a piece of cast iron about $2\frac{1}{4}$ in. diameter and 4 in. long. The iron is retained by a substantial head formed on the end of the shank by upsetting. Obviously the tool is used by sliding the cast-iron hammer back and forth on the shank after the manner of a battering ram.

Hacksaw Blade Makes Good Scratch Awl

By A. G. ALDEN
Shop Superintendent
A. E. Jacobson Machine Works, Inc.

Our sheet metal department experienced considerable difficulty in finding scratch awls with lasting qualities for working on black sheet iron. So, we devised awls made from scrap pieces of high-speed hack-saw blades by simply grinding a piece to a point and driving a piece of rubber hose on the large end for a handle. The corners of the awl need to be well rounded so as not to damage the straight edge. We find this "home-made" tool to be entirely satisfactory and the cost—only a few minutes of labor.



Involute-Spline Standards—III

Courtesy of the American Standards Association

THESE STANDARDS for side-bearing involute splines are intended to serve as a basis for the design of interchangeable spline shafts and fittings. They were developed by the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements, which is sponsored by the National Machine Tool Builders' Association, the S.A.E. and the A.S.M.E. More or less deviation from the standard will be necessary

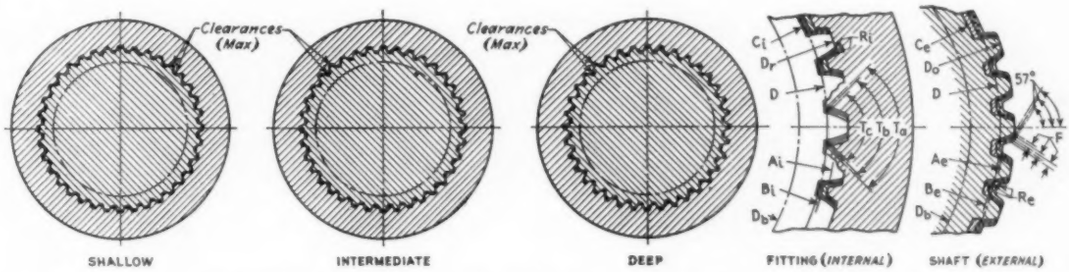


Table 9 Dimensions of 30 Deg Involute Splines With 36 Teeth—Fitting (Internal)

Corresponding Ball or Roller Bearing Bores		Pitch Diameter	Diametral Pitch	Base Diameter	Root Diameter		Inside Diameters: Shallow		Inside Diameters: Intermediate		Inside Diameters: Deep		Radius or Broach Chamfer		Circular Width of Space at the Pitch Line: Shallow	Circular Width of Space at the Pitch Line: Intermediate	Circular Width of Space at the Pitch Line: Deep
				D_b	D_r		A_i		B_i		C_i		R_i		T_a	T_b	T_c
					1.070D	1.060D	1.030D	1.029D	1.010D	1.009D	0.990D	0.989D	0.006D	Nil			
Bearing Number	Bore in Mm	D		D × 0.8660254	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	D × 0.068011	D × 0.061690	D × 0.055514
04	20	0.7500	48.0000	0.64952	0.803	0.795	0.773	0.772	0.758	0.757	0.743	0.742	0.0045	0.000	0.0510	0.0463	0.0416
05	25	0.9375	38.4000	0.81190	1.003	0.994	0.966	0.965	0.947	0.946	0.928	0.927	0.0056	0.000	0.0638	0.0578	0.0520
06	30	1.1250	32.0000	0.97428	1.204	1.193	1.159	1.158	1.136	1.135	1.114	1.113	0.0067	0.000	0.0765	0.0694	0.0625
07	35	1.3125	27.4286	1.13666	1.404	1.391	1.352	1.350	1.325	1.324	1.299	1.298	0.0079	0.000	0.0893	0.0810	0.0729
08	40	1.5000	24.0000	1.29904	1.605	1.590	1.545	1.543	1.515	1.514	1.485	1.483	0.0090	0.000	0.1020	0.0925	0.0833
09	45	1.6875	21.3333	1.46142	1.806	1.789	1.738	1.736	1.704	1.703	1.671	1.669	0.0101	0.000	0.1148	0.1041	0.0937
10	50	1.8750	19.2000	1.62380	2.006	1.988	1.931	1.929	1.894	1.892	1.856	1.854	0.0112	0.000	0.1275	0.1157	0.1041
11	55	2.0625	17.4545	1.78618	2.207	2.186	2.124	2.122	2.083	2.081	2.042	2.040	0.0124	0.000	0.1403	0.1272	0.1145
12	60	2.2500	16.0000	1.94856	2.408	2.385	2.317	2.315	2.273	2.270	2.227	2.225	0.0135	0.000	0.1530	0.1388	0.1249
13	65	2.4375	14.7692	2.11094	2.608	2.584	2.511	2.508	2.462	2.459	2.413	2.411	0.0146	0.000	0.1658	0.1504	0.1353
14	70	2.6250	13.7143	2.27332	2.809	2.783	2.704	2.701	2.651	2.648	2.599	2.596	0.0157	0.000	0.1785	0.1619	0.1457
15	75	2.8125	12.8000	2.43570	3.009	2.981	2.897	2.894	2.841	2.838	2.784	2.781	0.0169	0.000	0.1913	0.1735	0.1561
16	80	3.0000	12.0000	2.59808	3.210	3.180	3.090	3.087	3.030	3.027	2.970	2.967	0.0180	0.000	0.2040	0.1851	0.1665
17	85	3.1875	11.2941	2.76046	3.411	3.379	3.283	3.280	3.219	3.216	3.155	3.152	0.0191	0.000	0.2168	0.1966	0.1770
18	90	3.3750	10.6667	2.92284	3.611	3.578	3.476	3.473	3.408	3.405	3.341	3.338	0.0202	0.000	0.2295	0.2082	0.1874
19	95	3.5625	10.1053	3.08522	3.812	3.776	3.669	3.666	3.598	3.595	3.527	3.523	0.0214	0.000	0.2423	0.2198	0.1978
20	100	3.7500	9.6000	3.24760	4.013	3.975	3.862	3.859	3.788	3.784	3.713	3.709	0.0225	0.000	0.2550	0.2313	0.2082
21	105	3.9375	9.1429	3.40998	4.213	4.174	4.056	4.052	3.977	3.973	3.898	3.894	0.0236	0.000	0.2678	0.2429	0.2186
22	110	4.1250	8.7273	3.57235	4.414	4.373	4.249	4.245	4.166	4.162	4.084	4.080	0.0247	0.000	0.2805	0.2545	0.2290

All dimensions are given in inches.

Table 10 Dimensions of 30 Deg Involute Splines With 36 Teeth—Shaft (External)

Corresponding Ball or Roller Bearing Bores		Pitch Diameter	Diametral Pitch	Base Diameter	Outside Diameter		Root Diameters: Shallow		Root Diameters: Intermediate		Root Diameters: Deep		Radius		Chamfer or Broken Edge		Minimum Recommended Major Diam of Involute Profile
				D_b	D_o		A_e		B_e		C_e		R_e		F		
							1.010D	1.000D	0.990D	0.980D	0.970D	0.960D	0.006D	Nil	0.003D	Nil	
Bearing Number	Bore in Mm	D		0.8660254 × D	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
04	20	0.7500	48.0000	0.64952	0.7876	0.783	0.757	0.750	0.743	0.735	0.727	0.720	0.0045	0.000	0.0022	0.000	0.784
05	25	0.9375	38.4000	0.81190	0.9845	0.980	0.947	0.937	0.928	0.919	0.909	0.900	0.0056	0.000	0.0028	0.000	0.980
06	30	1.1250	32.0000	0.97428	1.1813	1.176	1.136	1.125	1.114	1.102	1.091	1.080	0.0067	0.000	0.0034	0.000	1.176
07	35	1.3125	27.4286	1.13666	1.3783	1.373	1.326	1.312	1.299	1.286	1.273	1.260	0.0079	0.000	0.0039	0.000	1.371
08	40	1.5000	24.0000	1.29904	1.5751	1.570	1.515	1.500	1.485	1.470	1.455	1.440	0.0090	0.000	0.0045	0.000	1.567
09	45	1.6875	21.3333	1.46142	1.7720	1.767	1.704	1.687	1.671	1.654	1.637	1.620	0.0101	0.000	0.0051	0.000	1.763
10	50	1.8750	19.2000	1.62380	1.9688	1.964	1.894	1.875	1.856	1.837	1.819	1.800	0.0112	0.000	0.0056	0.000	1.959
11	55	2.0625	17.4545	1.78618	2.1658	2.161	2.083	2.062	2.042	2.021	2.001	1.980	0.0124	0.000	0.0062	0.000	2.155
12	60	2.2500	16.0000	1.94856	2.3626	2.358	2.272	2.250	2.227	2.205	2.182	2.160	0.0135	0.000	0.0067	0.000	2.351
13	65	2.4375	14.7692	2.11094	2.5595	2.555	2.462	2.437	2.413	2.389	2.364	2.340	0.0146	0.000	0.0073	0.000	2.547
14	70	2.6250	13.7143	2.27332	2.7563	2.751	2.651	2.625	2.599	2.572	2.546	2.520	0.0157	0.000	0.0079	0.000	2.743
15	75	2.8125	12.8000	2.43570	2.9532	2.948	2.841	2.812	2.784	2.756	2.728	2.700	0.0169	0.000	0.0084	0.000	2.939
16	80	3.0000	12.0000	2.59808	3.1500	3.145	3.030	3.000	2.970	2.940	2.910	2.880	0.0180	0.000	0.0090	0.000	3.135
17	85	3.1875	11.2941	2.76046	3.3469	3.342	3.219	3.187	3.156	3.124	3.092	3.060	0.0191	0.000	0.0096	0.000	3.331
18	90	3.3750	10.6667	2.92284	3.5437	3.539	3.409	3.375	3.341	3.307	3.274	3.240	0.0202	0.000	0.0101	0.000	3.527
19	95	3.5625	10.1053	3.08522	3.7406	3.736	3.598	3.562	3.527	3.491	3.456	3.420	0.0214	0.000	0.0107	0.000	3.723
20	100	3.7500	9.6000	3.24760	3.9374	3.932	3.787	3.750	3.712	3.675	3.637	3.600	0.0225	0.000	0.0112	0.000	3.919
21	105	3.9375	9.1429	3.40998	4.1343	4.129	3.977	3.937	3.898	3.859	3.819	3.780	0.0236	0.000	0.0118	0.000	4.115
22	110	4.1250	8.7273	3.57235	4.3311	4.326	4.166	4.125	4.084	4.042	4.001	3.960	0.0247	0.000	0.0124	0.000	4.311

All dimensions are given in inches.

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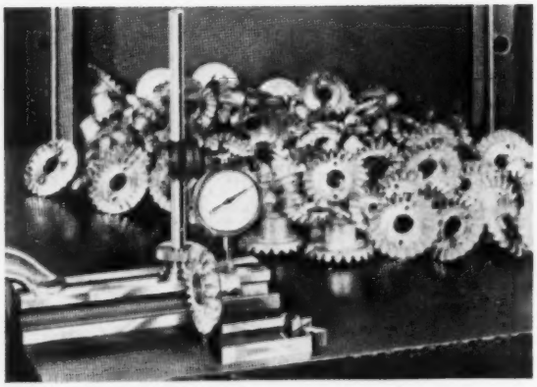

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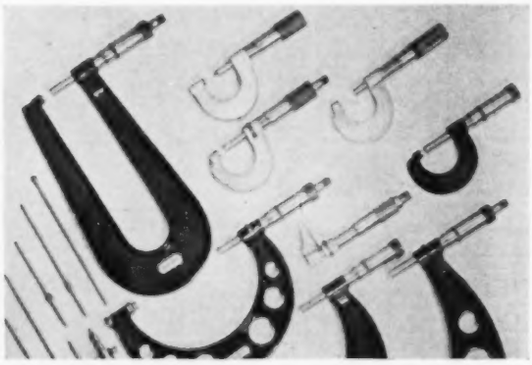

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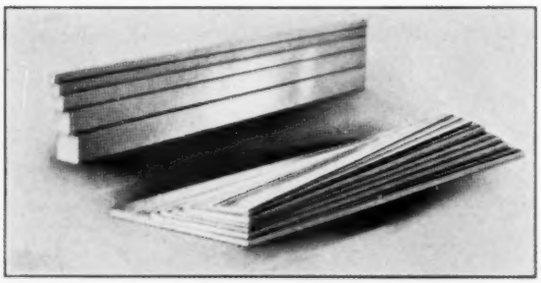

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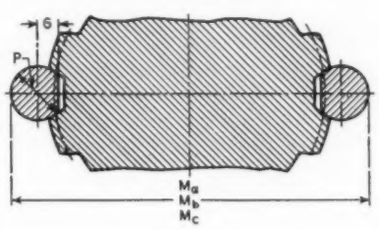
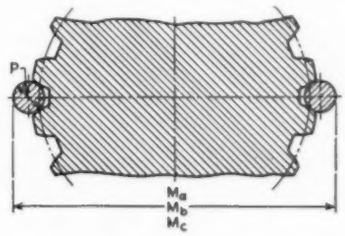
Involute-Spline Standards—III

to meet conditions imposed by engineering or production requirements.

The standard provides an option of three depths in each of five series covering 6, 10, 16, 24 and 36 tooth splines. The intermediate depth will probably be the most used, but it can be varied depending on the hardness of the spline members. Dimensions for 6, 10, 16 and 24 tooth splines have been published (*AM*—Vol. 84, pages 431, 433, 473 and 475).



For 6 and 10 Tooth Splines



For 16, 24 and 36 Tooth Splines

Table 1 Measurement of Involute Splines With 6 and 10 Teeth—on Shafts

Corresponding Bearing Bore Numbers	6-Tooth Splines						10-Tooth Splines					
	Pitch Diameter	Pin Diameter	Center to Flat	Measurement Over Pins			Pitch Diameter	Pin Diameter	Center to Flat	Measurement Over Pins		
				Shallow	Interm.	Deep				Shallow	Interm.	Deep
	D	P	G	M_a	M_b	M_c	D	P	G	M_a	M_b	M_c
		D × 0.3660253	0.4P	D × 1.601561	D × 1.590770	D × 1.580365		D × 0.2012936	0.4P	D × 1.327740	D × 1.315660	D × 1.303923
04	0.7500	0.2745	0.110	1.2012	1.1931	1.1853	0.7500	0.1510	0.060	0.9958	0.9867	0.9779
05	0.9375	0.3431	0.137	1.5015	1.4913	1.4816	0.9375	0.1887	0.075	1.2448	1.2334	1.2224
06	1.1250	0.4118	0.165	1.8018	1.7896	1.7779	1.1250	0.2265	0.091	1.4937	1.4801	1.4669
07	1.3125	0.4804	0.192	2.1020	2.0879	2.0742	1.3125	0.2642	0.106	1.7427	1.7268	1.7114
08	1.5000	0.5490	0.220	2.4023	2.3862	2.3705	1.5000	0.3019	0.121	1.9916	1.9735	1.9559
09	1.6875	0.6177	0.247	2.7026	2.6844	2.6669	1.6875	0.3397	0.136	2.2406	2.2202	2.2004
10	1.8750	0.6863	0.275	3.0029	2.9827	2.9632	1.8750	0.3774	0.151	2.4895	2.4669	2.4449
11	2.0625	0.7549	0.302	3.3032	3.2810	3.2595	2.0625	0.4152	0.166	2.7385	2.7135	2.6893
12	2.2500	0.8236	0.329	3.6035	3.5792	3.5558	2.2500	0.4529	0.181	2.9874	2.9602	2.9338
13	2.4375	0.8922	0.357	3.9038	3.8775	3.8521	2.4375	0.4907	0.196	3.2364	3.2069	3.1783
14	2.6250	0.9608	0.384	4.2041	4.1758	4.1485	2.6250	0.5284	0.211	3.4853	3.4536	3.4228
15	2.8125	1.0294	0.412	4.5044	4.4740	4.4448	2.8125	0.5661	0.226	3.7343	3.7003	3.6673
16	3.0000	1.0981	0.439	4.8047	4.7723	4.7411	3.0000	0.6039	0.242	3.9832	3.9470	3.9118
17	3.1875	1.1667	0.467	5.1050	5.0706	5.0374	3.1875	0.6416	0.257	4.2322	4.1937	4.1563
18	3.3750	1.2353	0.494	5.4053	5.3688	5.3337	3.3750	0.6794	0.272	4.4811	4.4404	4.4007
19	3.5625	1.3040	0.522	5.7056	5.6671	5.6301	3.5625	0.7171	0.287	4.7301	4.6870	4.6452
20	3.7500	1.3726	0.549	6.0059	5.9654	5.9264	3.7500	0.7549	0.302	4.9790	4.9337	4.8897
21	3.9375	1.4412	0.576	6.3061	6.2637	6.2227	3.9375	0.7926	0.317	5.2280	5.1804	5.1342
22	4.1250	1.5099	0.604	6.6064	6.5619	6.5190	4.1250	0.8303	0.332	5.4769	5.4271	5.3787

All dimensions are given in inches.

Table 2 Measurement of Involute Splines With 16, 24, and 36 Teeth—on Shafts

Corresponding Bearing Bore Numbers	16-Tooth Splines					24-Tooth Splines					36-Tooth Splines				
	Pitch Diameter	Pin Diameter	Measurement Over Pins			Pitch Diameter	Pin Diameter	Measurement Over Pins			Pitch Diameter	Pin Diameter	Measurement Over Pins		
			Shallow	Interm.	Deep			Shallow	Interm.	Deep			Shallow	Interm.	Deep
	D	P	M_a	M_b	M_c	D	P	M_a	M_b	M_c	D	P	M_a	M_b	M_c
		D × 0.1205850	D × 1.199013	D × 1.186008	D × 1.173280		D × 0.0786596	D × 1.147595	D × 1.133819	D × 1.120219		D × 0.0517190	D × 1.116248	D × 1.106751	D × 1.097297
04	0.7500	0.0904	0.8993	0.8895	0.8800	0.7500	0.0590	0.8607	0.8504	0.8402	0.7500	0.0388	0.8372	0.8301	0.8230
05	0.9375	0.1130	1.1241	1.1119	1.1000	0.9375	0.0737	1.0759	1.0630	1.0502	0.9375	0.0485	1.0465	1.0376	1.0287
06	1.1250	0.1357	1.3489	1.3343	1.3199	1.1250	0.0885	1.2910	1.2755	1.2602	1.1250	0.0582	1.2558	1.2451	1.2345
07	1.3125	0.1583	1.5737	1.5566	1.5399	1.3125	0.1032	1.5062	1.4881	1.4703	1.3125	0.0679	1.4651	1.4526	1.4402
08	1.5000	0.1809	1.7985	1.7790	1.7599	1.5000	0.1180	1.7214	1.7007	1.6803	1.5000	0.0776	1.6744	1.6601	1.6459
09	1.6875	0.2035	2.0233	2.0014	1.9799	1.6875	0.1327	1.9366	1.9133	1.8904	1.6875	0.0873	1.8837	1.8676	1.8517
10	1.8750	0.2261	2.2481	2.2238	2.1999	1.8750	0.1475	2.1517	2.1259	2.1004	1.8750	0.0970	2.0930	2.0752	2.0574
11	2.0625	0.2487	2.4730	2.4461	2.4199	2.0625	0.1622	2.3669	2.3385	2.3105	2.0625	0.1067	2.3023	2.2827	2.2632
12	2.2500	0.2713	2.6978	2.6685	2.6399	2.2500	0.1770	2.5821	2.5511	2.5205	2.2500	0.1164	2.5116	2.4902	2.4689
13	2.4375	0.2939	2.9226	2.8909	2.8599	2.4375	0.1917	2.7973	2.7637	2.7305	2.4375	0.1261	2.7209	2.6977	2.6747
14	2.6250	0.3165	3.1474	3.1133	3.0799	2.6250	0.2065	3.0124	2.9763	2.9406	2.6250	0.1358	2.9302	2.9052	2.8804
15	2.8125	0.3391	3.3722	3.3356	3.2999	2.8125	0.2212	3.2276	3.1889	3.1506	2.8125	0.1455	3.1394	3.1127	3.0861
16	3.0000	0.3618	3.5970	3.5580	3.5198	3.0000	0.2360	3.4428	3.4015	3.3607	3.0000	0.1552	3.3487	3.3203	3.2919
17	3.1875	0.3844	3.8219	3.7804	3.7398	3.1875	0.2507	3.6580	3.6140	3.5707	3.1875	0.1649	3.5580	3.5278	3.4976
18	3.3750	0.4070	4.0467	4.0028	3.9598	3.3750	0.2655	3.8731	3.8266	3.7807	3.3750	0.1746	3.7673	3.7353	3.7034
19	3.5625	0.4296	4.2715	4.2252	4.1798	3.5625	0.2802	4.0883	4.0392	3.9908	3.5625	0.1842	3.9766	3.9428	3.9091
20	3.7500	0.4522	4.4963	4.4475	4.3998	3.7500	0.2950	4.3035	4.2518	4.2008	3.7500	0.1939	4.1859	4.1503	4.1149
21	3.9375	0.4748	4.7211	4.6699	4.6198	3.9375	0.3097	4.5187	4.4644	4.4109	3.9375	0.2036	4.3952	4.3578	4.3206
22	4.1250	0.4974	4.9459	4.8923	4.8398	4.1250	0.3245	4.7338	4.6770	4.6209	4.1250	0.2133	4.6045	4.5653	4.5264

All dimensions are given in inches.

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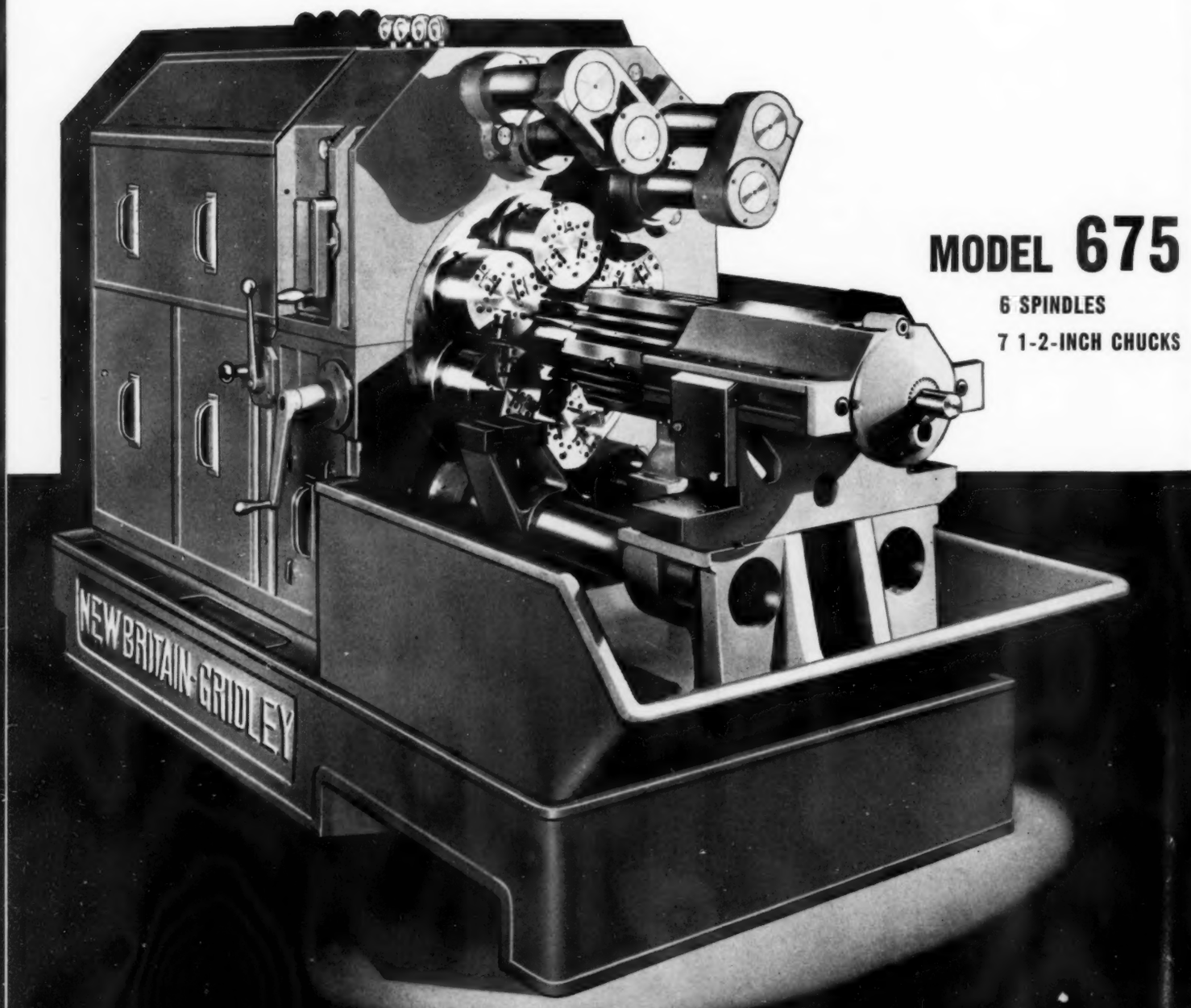

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Also a complete line of Screw Machines — Four and Six Spindles to 2 1/4" Capacity

Defense Bottlenecks

WE HAVE BEEN HEARING a lot about bottlenecks in national defense. You don't have to visit the Army and Navy in Washington to get an earful on the subject. Just read the newspapers or listen to the radio or, for that matter, drop in at any gathering place.

What is meant by bottlenecks? If you asked most people that question, they probably wouldn't know. Here is the best explanation we can give: Americans went on their own sweet way for years paying little or no attention to defense matters. The armed forces were starved for funds. Manufacture of munitions fell away to next to nothing. A group of intellectual writers smeared munitions makers with the title "Merchants of Death." But what of it?

Well, nothing, until one day recently we woke up to the realization that we are living in a world largely ruled by the strong-arm nations. We got scared at our own softness and at our inability to command respect armed with popguns and feather dusters. So Congress began to appropriate billions, a habit which it has fallen into lately.

But mere appropriation of billions doesn't solve anything in itself, as we have discovered in connection with unemployment. We must have everything for defense purposes immediately or sooner! Guns, airplanes, shells, tanks.

Unfortunately that is impossible. It will take months, perhaps even years to attain the defense goal some have set for us.

How are we going to speed up the process as much as possible? Not by imposing rigid restrictions on work-weeks, not by the Government's refusing to liberalize its write-offs on plant additions designed for defense production, not by waiting until every t is crossed and every i dotted before munitions contracts are placed.

Bottleneck in machine tools? Not if we know it. Any industry with an average business of $100,000,000 a year which can pull itself up by its bootstraps to an output of $400,000,000 a year can meet any emergency which might arise. It already has functioning a voluntary system designed to give the defense program the green light over everything else. It has in its hand a trump or two yet to play if things get tight.

We are not concerned about the industrial bottlenecks which people like to talk about and which the newspapers like to write about. Given half a chance, American industry will be able to give a sterling account of itself in the manufacture of war goods.

What we are more afraid of than industrial bottlenecks is the Washington bottleneck. For some inexplicable reason the hardest job many government officials have to do is to use the scissors to cut the red tape which binds them. It is impossible for manufacturers even to begin tooling for munitions manufacture until they know what they are to make and how much of it and until they are sure the job is "in the bag."

So we are forced to the conclusion that if a choke point exists today, it is in Washington rather than in the industrial hinterland. And if we know Bill Knudsen as we think we do, he will eliminate that choke point in a hurry if he is given the authority.

Burnham Finney

GAGING BUSINESS

Machine tools on British order to be delivered to U. S. plants holding British munitions contracts. Japan has $26,000,000 of U. S. tools on order. June was big month for machine builders

Machine Tools—June bookings are reported by many companies to have been the best of the year. British orders were large. Aviation companies and makers of industrial electrical equipment were among the biggest domestic buyers, much of the purchasing being for armament programs. Pratt & Whitney Aircraft, Wright, Aviation Manufacturing and Bethlehem Steel have been among the important companies in the market. Government arsenals and navy yards also have been placing generous orders.

The British have taken over all French machine tool contracts in the United States with the exception of a few highly specialized units unadaptable to British work. Instead of shipping huge quantities of machine tools to England for installation there, it is believed that most U. S. machines currently on British order will be delivered to plants in this country holding British munitions contracts. Heretofore practically all machines bought by the British have been shipped overseas.

British orders here, including those acquired from the French, are said to total over $125,000,000. The French alone had 11,500 machines on order. Early in June U. S. machine tool builders had on hand Japanese business amounting to $26,000,000 and Russian business totaling $9,000,000. Most of the machines for Russia are understood to have been shipped since then, but few of those for Japan. The severe control of machine tool exports clamped down by Washington is expected to make it difficult for Japan to get the machines she needs, unless the equipment is so specialized that it cannot be converted to U. S. defense purposes.

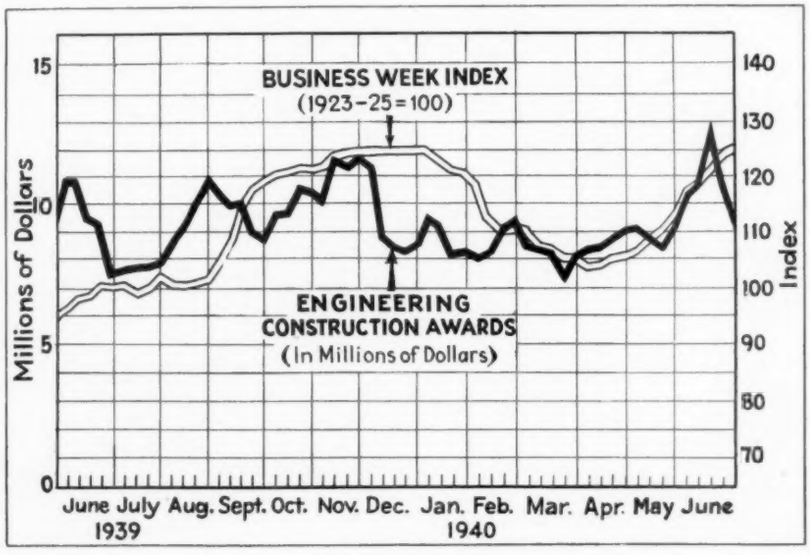
Ordnance—The War Department is expected to spend around $40,000,000 for a new powder-making plant, an ammunition-loading plant and enlargement of productive facilities at Springfield Armory. The new naval bill, passed by the House and certain of enactment by the Senate, provides $50,000,000 for expansion of ordnance-making capacity and $20,000,000 for added armor plate capacity. Despite a record peacetime procurement program for fiscal 1941, the Army's Ordnance Department still expects to place a large number of educational orders in coming months. Westinghouse, which turned out huge quantities of munitions in World War days, has formed an Emergency Products Division to produce ordnance material for the government. It is reported to have received an order for guns to be made at its Jersey City plant.

Railroad Equipment—Freight car orders and inquiries the past fortnight totaled almost 10,000 units. Programs recently announced indicate that $250,000,000 may be spent in the final half of 1940 for rolling stock, with emphasis on mill-type freight cars because of the necessity for moving raw and finished steel products. Railroads now have 35,784 more cars in service than in October, 1939. Outstanding inquiries include 3,000 cars for the Illinois Central, 2,345 for the Pennsylvania, and 2,275 cars and 20 locomotives for the Southern Pacific.

Aircraft—U. S. military plane production is estimated at about 500 units a month, but plant expansions will increase that rate sharply in the next four months. Vega, Vultee, Consolidated and North American are among companies enlarging their factories. A leading plane builder is contemplating tripling its capacity. Wright, Pratt & Whitney and Allison are making considerable progress in adding to their engine output. The latter hopes to be up to 400 units a month within six weeks. It now is producing about 10 units a day. Packard will spend $30,000,000 in tooling up for Rolls Royce engine production. Continental Motors, Stearman Aircraft and Aviation Manufacturing have received further substantial government orders recently.

Shipbuilding—Contracts for new docks at Norfolk and Philadelphia Navy yards costing $16,175,000 are a forerunner of other contracts to increase capacities in private as well as government yards. Actual construction work on new private facilities may be delayed because of the reported reluctance of the U. S. Treasury Department to liberalize taxation valuations and depreciation rates in connection with this emergency program. Operations at navy yards can be further expanded by adding more shifts, but a shortage of certain types of skilled labor is a limiting factor. General Motors, Fairbanks Morse and Hooven-Owens-Rentschler have received large orders for submarine propulsion machinery.

Steel—After a decline during the holiday week, steel production bounced back up this week. Only a minor fraction of today's tonnage is coming from the new defense program. The major effect of armament activities will not be felt for some time. Meanwhile domestic demand and British buying are expected to maintain operations at a high rate.



LICENSES NEEDED FOR MACHINE TOOL EXPORTS

Industrial mobilization plan virtually put into effect. Metal-working equipment, materials and parts come under rigid scrutiny. Lt. Col. Maxwell will be Administrator

WASHINGTON — Immediately upon signing H. R. 9850, which virtually puts into effect the 1939 industrial mobilization plan of the War Department, President Roosevelt issued a proclamation putting all export shipments of munitions, materials or machinery needed in the national defense program under rigid control.

All machine tools, as well as many other kinds of metal-working machinery, are on the list for export control. The Presidential proclamation includes "metal working machinery for (1) melting or casting, (2) pressing into forms, (3) cutting or grinding, power-driven, and (4) welding." Armor plate, optically clear plastics, and aircraft parts, equipment and accessories are on the list. The group of basic materials and products consists, in part, of aluminum, chromium, industrial diamonds, manganese, molybdenum, tungsten and vanadium.

Lieut.-Col. Russell L. Maxwell has been appointed by Mr. Roosevelt as Administrator of Export Control. He will have final authority, even exceeding that of the State Department, in determining whether products on the affected list may be exported. Actual licenses for shipments abroad must be obtained from the State Department. No exports may be made without a license.

It was in anticipation of this action that machine tools destined for Japan and Russia, in particular, were held up recently, precipitating a vigorous protest from the Japanese ambassador. The upshot is that such holdups temporarily ceased. With an official control in effect, however, the government will clamp down again. It is believed that only a few machines not adaptable to our defense needs will hereafter slip through to Japan. The same situation applies to contemplated shipments to many other countries.

Some equipment destined for Britain probably will be taken for the Army and Navy, but not enough to interfere with the British getting most of what they want.

The new Export Administrator, Lt.-Col. Maxwell, has his office in Room 2068 Munitions Building in Washington. Since last August he has been Chief of the Planning and Equipment Branch of the War Department General Staff. From December, 1938, to August, 1939, he was assistant to the executive officer in the office of the Assistant Secretary of War. He has served in ordnance operations, having been on duty in the office of the Chief of Ordnance on three separate occasions. In 1934–1935 he was executive assistant to the Chief of the Philadelphia Ordnance District and later was ordnance officer at Langlay Feld, Va. He was commanding officer of the Picatinny Arsenal from October, 1918, to January, 1919, and was with the American forces in Germany as commanding officer of the Hallaschlag and Mulheim Ammunition plants from July, 1919, to July, 1921. He is a West Point graduate.

EXPORT LICENSE INSTRUCTIONS

FOR MACHINE TOOLS

1. One duplicate application should be made for each complete shipment to any one consignee, and may not include more than one commodity nor shipments to more than one country.
2. Applications should be typewritten, but will be considered if written legibly in ink. Unsigned applications or those omitting essential information called for will be returned.
3. The commodity listed should be designated clearly and specifically, the type and model designation being included whenever applicable. Values listed should represent the selling price only of the articles exported, and should not include such supplementary costs as packing, freight, etc.
4. When countersigned and impressed with the seal of the Department of State, an application becomes a license.
5. Any attempt to export a commodity differing in any way from that licensed or any alteration of a license, except by a duly authorized officer of the government, is punishable under appropriate acts of Congress. Changes in the information set forth in licenses which have been issued under the seal of the Secretary of State can be effected by amendments which can be made only by the Department of State, or by collectors of customs or postmasters acting under the specific instructions of the Department of State.
6. A license is not transferable and is subject to revocation without notice.
7. Shipment must be made from port of exit within one year from date license is granted.
8. Export licenses must be filed with the collector of customs at the port from which the shipment is departing from the United States prior to the proposed departure.

BRITISH ASSUME FRENCH ORDERS

NEW YORK—The British Purchasing Mission will positively take over all the French machine tool orders in this country. The number is estimated to be 11,500. For those machines tied in with the metric system, making the problem of conversion difficult, a solution is now being worked out by the Mission. It probably will be ten days to two weeks before the French orders are completely straightened out and transferred to the British.

Navy Orders 45 New Warships At Total Cost of $414,000,000

WASHINGTON — The Navy has moved nearer its goal of superiority over any probable fleet combination on earth by ordering 45 new warships at a cost of $414,000,000. It calls for 11 cruisers, 20 destroyers, 13 submarines and one large seaplane tender, all to be built in private yards as follow: Bath Iron Works—6 destroyers; Bethlehem steel Co.—8 cruisers and 4 destroyers; Electric Boat Co.—13 submarines; Federal Shipbuilding & Dry Dock Co.—10 destroyers; New York Shipbuilding Corp.— 3 cruisers and 1 seaplane tender. The terms of this 45-ship deal do not cover armament, armor and ammunition, or propelling machinery for the submarines.

This order is in addition to all recently announced contracts. A few days ago the Navy let contracts for 19 vessels in its own yards. Also, orders have been awarded the Newport News Shipbuilding and Dry Dock Co. for two cruisers and three aircraft carriers. Altogether there are 92 warships under construction, totaling 499,435 tons, which will cost $1,140,000,000.

The 70 per cent expansion bill just passed by the House and now before the Senate provides of an additional eight or nine battleships, seven aircraft carriers, 30 cruisers, 120 destroyers and 47 submarines. The bill is only an authorization and does not provide appropriations.

The two-ocean navy, ships for which are either built, under construction or proposed, will consist of more than 30 battleships, at least 15 aircraft carriers, 400 destroyers, and a swarm of light and heavy cruisers.

Labor Rivalry a Threat to Defense Plans; Hillman Achieves Success As Peacemaker

NEW YORK — One of the major threats to uninterrupted defense production has been the prospect of CIO - AFL jurisdictional wrangling that might tie up vital industries. For the last three years, the launching of an organizing campaign by the CIO has been the signal for a countermove by the AFL designed to halt CIO expansion.

Specter Dispersed

With two industries which are crucial to defense preparation largely unorganized — aircraft manufacture and machine tools — the specter of labor tugs-of-war which would hamper production in these fields has given planners nightmares. CIO's United Automobile Workers Union and United Electrical, Radio, and Machine Workers, and AFL's International Association of Machinists each claim a jurisdictional stake. Determinedly staking out such claims would mean strikes and chaos.

That defense minded Washington was sensitive to such potential trouble is indicated by the Roosevelt appointment of labor leader Sidney Hillman to the key post of Employment Policies Coordinator in the recently established Defense Advisory Council. Hillman's job, as Stettinius looks after raw materials, and Knudson gets armament manufactured, is to keep on tap an adequate labor supply. It is because picket lines can cork up a labor bottleneck in short order that Hillman's job is that of peacemaker.

Long an ardent and vocal champion of labor unity, even when it put him at sixes and sevens with Generalissimo John L. Lewis, Hillman, after the AFL went through the motions of protesting his appointment because he heads a CIO union, can command the respect of all temperate sections of the labor movement. Addressing himself to the problem, one of his first official acts upon assuming his new position was to call in R. J. Thomas, president of CIO Auto Workers Union, and H. W. Brown, chief of AFL's machinists for a down-to-earth confab.

The result of that meeting was that these two leaders, whose respective organizations had had a dagger's drawn attitude toward each other, agreed on each other's jurisdiction, saw to it that there was no spot for conflict, and proceeded to shake hands as token that they would respect each other's field.

Further Peace Moves

Hillman's next step to insure effective labor peace, in spite of the Lewis-Green hostility, was to create a national Labor Policy Advisory Committee, whose formation was announced July 2. The new committee's personnel is made up of eight AFL leaders, six CIO union chiefs, and two officials from the railroad brotherhood unions. These men represent organizations who have well over a million members employed in industries important to the defense effort. That after five years of bitter AFL-CIO factional war these organizations could come together, discarding personal and organizational differences, in a pledge of united and cooperative effort in furtherance of the national defense program is a heartening sign. Observers are suggesting that it presages labor unity.

KNUDSEN APPOINTS AIDES

WASHINGTON—Mason Britton, vice-chairman of the McGraw-Hill Publishing Co., Inc., has been appointed to the staff of William S. Knudsen of the National Advisory Defense Commission to assist in the procurement of machine tools for the defense program. A. B. Einig, Motch & Merryweather Machinery Co., and Don Laflin, Giddings and Lewis Machine Tool Co., also have been appointed to assist Mr. Knudsen.

MORE POWER FOR ALLIED BUYERS

OTTAWA—Beginning July 1, C. D. Howe, Minister of Munitions and Supply in Canada, and Arthur B. Purvis, purchasing agent in the United States, took over complete control of British war purchases on this continent. This removes at a stroke all the overseas restrictions which, since the war started, have slowed up Allied purchasing on this side of the ocean. The British War Supply Board has disappeared; it was not only responsible for purchases in Canada but exercised control over the British Purchasing Commission in the United States.

MACHINERY EXPORTS DECLINE

WASHINGTON—Exports of power-driven metal-working machinery in May amounted to $19,142,225, compared with $21,281,332 in April. Both months are well over the exports for May 1939, which was $11,615,799.

Exports in May included engine lathes, $1,393,405; turret lathes, $1.-657,448; thread cutting and automatic screw machines, $1,729,593; milling machines, $2,315,698; drilling machines $932,470; grinders, $3,321,-142; sheet and plate metal-working machines and parts, $756,652; and forging machinery parts and accessories, $1,261,457.

Land Battleships—*Cruiser tanks equipped with revolving turrets are assembled at a depot somewhere in the English Midlands. One of the tanks is seen being lifted over others for final assembling. Peak production is rapidly being approached by British factories*

Recent Bills Give Administration More Power; Set Up New Pattern for Military Procurement

WASHINGTON—In the landslide of defense legislation last month, major attention went to the appropriation bills that so far added up nearly $5,000,000,000 for armament. But at the same time a group of bills slid through which set up a brand new pattern for military procurement. Designed primarily to speed up production for a vast new army and navy, the bills sweep aside the cautious restrictions which usually surround government buying and grant broad powers which, if pushed to their limits, could regiment industry into a virtual industrial mobilization. Secondarily, the new regulations aim to prevent profiteering and to keep labor from bearing the burden of defense. These new powers expire June 30, 1942.

Competitive bidding will not enter into the expansion program. Army and Navy can now negotiate contracts on everything they buy, and, except on minor and routine items, they are going to use the power. The cost-plus-a-percentage contracts of the last war are forbidden, but contracts may be negotiated on a lump sum or on a cost-plus-a-fixed-fee basis. The latter form will probably be used only on construction work for the present. The fee shall not exceed 7 per cent of the cost.

Profit limitations are imposed on producers of ships and of Army and Navy airplanes. Profits of other contractors are not restricted, but excess profit legislation will be enacted to keep builders of tanks, machine guns and other munitions from making too much money. Restrictions on ship and airplane builders come in through a tightening of the Vinson-Tramel Law which formerly restricted ship profits to 10 per cent and airplane to 12 per cent. These limits are now reduced to a uniform 8 per cent of the contract price. To cover cases in which the cost is less than anticipated, it is also stipulated that profit shall not exceed 8.7 per cent of the cost of performing the contract. The same limits apply to subcontracts if over $25,000. Although these percentages look liberal, many manufacturers fear that, because of tax and overhead items not counted as costs, actual profits will not exceed 4 or 5 per cent.

An important concession is made to shipbuilders and plane manufacturers on the matter of distributing cost of plant expansion and tooling. In a program such as the present involving great expansion of capacity, it is vital how much of the cost of new facilities may be charged against the contract as a legitimate cost. Previously, this determination has been made, after the contract award, by the Treasury, which has simply allowed the same amortization rate as for income tax. The new legislation provides that the determination be made before the contract is awarded and that it be made by the Army and Navy—who have long been fighting for a more liberal interpretation. Treasury retains only veto power over each decision (which, some fear, may produce delaying deadlocks.)

Limitations on ship and plane profits—and probably on other items through taxation—create the danger of deadlock in negotiations between purchasing officers and manufacturers. To meet this eventuality, the legislation empowers Army and Navy to manufacture what they need for their own account. To this end, they may build plants or lease existing plants and either operate them themselves or contract for their operation. The Secretary of the Navy, moreover, if he finds that he needs a plant, may determine a fair compensation and compel the owner to lease it to him. The Secretary of War, curiously enough, is not granted this power.

Application of Walsh-Healey requirements of prevailing wage, and time-and-a-half after 40 hours, to defense production was bitterly opposed by the military, but Congress ended by throwing the problem in the President's lap. The restrictions remain in force, but the President is empowered to waive them if he finds it desirable. Civilian employees of Army, Navy, and Coast Guard, hitherto restricted to a maximum workweek of 40 hours, may now be required to work longer if paid time and a half.

Priority System for Machine Tools Established in Canada

MONTREAL—A priority system for machine tools has been established in Canada. It will function through the newly-formed Citadel Merchandising Co., fully owned by the government, which will have dictatorial authority over machine tool production and shipments. The new organization extends beyond machine tools, being charged with responsibility for insuring the supply of all equipment essential to Canadian war industries.

The new company is managed by business leaders independent of all machine tool companies. It is operated on a non-profit basis and will have offices in Montreal and representatives in New York and Ottawa. It already is attempting to coordinate production and procurement of machine tools in Canada and to assist firms occupied with war orders to obtain adequate equipment.

The new company is to be operated under the direct supervision of Hon. C. D. Howe, minister of munitions and supply, and will be administered by the following directors, all of whom are to serve without remuneration: Thomas Arnold, chairman, Manitoba Steel Foundries Ltd., president; L. J. Belnap, president, Consolidated Paper Corp., Ltd., vice president; J. D. Johnson, president Canada Cement Co., Ltd., C. E. Gravel, director, Bell Telephone Co. of Canada; F. J. Morrow, director, Ogilvie Flour Mills Co., Ltd.

Government control of machine tool production is but a part of a wide program for the mobilization of Canadian industry by the government for war purposes. Other boards have been formed such as the War-time Industries Control Board consisting of controllers for various branches of industry each of whom has dictatorial powers over anything affecting the industries.

The WICB will elect a chairman from its own members which include: Hugh Scully, Ottawa, steel controller; G. C. Bateman, Toronto, controller of metals production; H. R. McMillan, Vancouver, timber controller; and G. Cotrelle, Toronto, oil controller. President of Federal Aircraft Ltd. is R. P. Bell, head of Pickford & Black, Ltd. and the directors are: S. Dawes, B. Gordon, R. Smith, and A. Aiken.

EDUCATIONAL ORDERS CONTINUED

WASHINGTON—The 1941 Educational Orders Program is getting under way. Supported by an appropriation of $16,250,000 the War Department is issuing circular proposals on many of what it terms as "sixty critical items." Only those companies not having regular war orders are eligible to bid. Although it was previously predicted that big scale war orders would submerge the Educational Orders Program, such is not the case and indications are that it will go on as long as there are firms that can aid defense and which need experience.

RECENT OUTSTANDING WAR ORDERS

WASHINGTON—The White Motor Co. of Cleveland, Ohio has recently been awarded a $5,387,500 contract by the government for scout cars with spare parts, while the Sperry Gyroscope Co. has been awarded a $4,571,887 contract for anti-aircraft fire control instruments. The Wright Aeronautical Corp was awarded a contract for $1,488,272 engines.

Administration Moves to Train 250,000 Men for Industrial Jobs

WASHINGTON—Last week the Administration, in its first important move to remedy the lack of trained workers for defense industries, started the enrollment of 150,000 men in the nation's vocational schools, under allotment of $9,781,340 of WPA funds and $7,500,000 of $15,000,000 recently voted to the Office of Education by Congress. The program is in charge of Sidney Hillman, member of the National Defense Commission. The NYA will train an additional 100,000 men.

About 50,000 enrollees will be taken from WPA rolls. The balance will be selected by state and federal employment services. Some will be employed men who wish to improve their skill. Vocational training facilities of public schools will be utilized by the Office of Education. Local officials, and representatives of employers and labor will advise. WPA trainees will receive regular pay.

Classes will be held in July, August, and September, at about 600 schools. Courses will average 40 to 42 hours for 10 weeks. Occupations will include aircraft mechanics, machinists, sheet metal workers, welders, pattern makers, blacksmiths, riveters, lathe operators, punch press operators, drill press, draftsmen. Engineering schools can give instruction in testing, instrument making, machine tool manufacture, specification writing and blue printing, but this higher type seems not likely to be emphasized just yet.

In addition more than 100,000 young men are being trained for industry and technical skills needed in the supply of equipment by the National Youth Administration. John Haien, Director of youth training for the Chrysler Corporation, will be in charge of this program.

The Army and Navy are pushing their own mechanics training program. The Civil Aeronautics Authority is giving courses in mechanics in connection with its pilot program. The Labor Department's Apprenticeship Committee is putting more steam behind apprenticeships by employers, which, however, is a slow process, good for only high skills and a long pull.

WATCH MACHINE EXPORT ORDERS

WASHINGTON — Machinery builders have been told that they should not accept new export orders until they have been granted an export license by the Department of State. To expedite handling foreign orders received prior to the President's proclamation of July 2, builders should refrain from starting to process any further machines involving metric equipment or extensive special tooling until export licenses have been favorably acted upon. They have been asked to submit to the Army and Navy Munitions Board information on machines or groups of identical machines in process or finished on hand which involve metric or special equipment or special tooling. Builders will be notified quickly whether export licenses will be granted for such machines.

New British War Orders Stimulate Canadian Plants

MONTREAL—The Canadian Government War Supply Board and predecessor purchasing agency have placed 20,000 orders for munitions with Canadian plants in the past few months. Including those placed for the British government, the value of all contracts exceeds $300,000,000. Munition orders placed in Canada by the British government directly in the past few weeks are valued at $25,000,000. Last week Canada announced its budget for the next fiscal year—$1,300,000,000.

To supply such increased quantities of munitions, 35 expansions in Canada are being financed by the British government. At present Britain has committed over $50,000,000 for expansion while the value of the annual production is expected to be about $250,000,000 of war materials. In addition Britain has guaranteed to purchase the output of the expanded plants for at least a year ahead.

The British-financed plant expansion in Canada includes two explosives plants being erected at a cost of $20,000,000. Work on an $8,000,000 shell-filling plant has been started by Canadian Car and Foundry.

Some thirteen plants are now making shells for the British government. One plant is making 25-pounder field guns with carriages and instruments, and four are turning out 3.7-in. and 40-mm. gun barrels.

Other Canadian production for the British government includes bombing and fighting planes, minesweepers and anti-submarine boats, and small arms ammunition.

Noorduyn Aviation Limited has received an additional order for aircraft from the Canadian government amounting to $1,226,460 which brings the total value of all aircraft ordered by Canada to over $5,000,000.

Canadian Vickers Limited has unfilled orders on its books of approximately $9,000,000 for aircraft as well as small naval craft.

Colonel Campbell Heads New Ordnance Facilities Division

WASHINGTON — Lt. - Col. Levin Campbell, formerly head of the artillery and ammunition department at the Frankford Arsenal, has been transferred to Washington in full charge directly under General Harris of the newly created Facilities Division of the Ordnance Department. His department will have responsibility for all shell, ammunition and powder-producing facilities. Major E. C. Bomar succeeds him at Frankford. Col. Burton O. Lewis, heretofore at Aberdeen Proving Grounds, has been made special assistant to General Harris at Washington.

U. S. Government Contracts Awarded to Metal-Working Firms

(Defense Contracts on Page 517j)

Contractor	Gov't Agency	Commodity	Amount
U. S. Motors Corp., Oshkosh, Wis	Signal Corps	Power units	$104,800
General Electric Co., Schenectady, N. Y	GPO, TVA	Electrical equipment	60,063
American Transformer Co., Newark, N. J	Interior	Electrical equipment	81,616
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa	Interior,TVA,NACA	Electrical equipment	231,616
Allis-Chalmers Mfg. Co., Milwaukee, Wis	TVA, Navy	Electrical equipment	62,018
Cutler-Hammer, Inc., Milwaukee, Wis	Interior	Electrical equipment	69,085
Cessna Aircraft Co., Wichita, Kan	CAA	Airplanes	99,568
B. F. Sturtevant Co., Boston, Mass	Navy	Blowers	539,213
Hardie Tynes Mfg. Co., Birmingham, Ala	Navy	Air compressor	43,420
Cyclops Iron Works, San Francisco, Calif	Interior	Crane	52,580
Worthington Pump & Machinery Corp., Harrison, N. J	Engineer Corps	Pumps	49,986
Bay City Shovels, Inc., Bay City, Mich	Engineer Corps	Shovels	104,200
Wolfe & Mann Mfg. Co., Baltimore, Md	Panama Canal	Switchgear	51,952
Magor Car Corp., New York, N. Y	Panama Railroad	Flat cars	209,460
Consolidated Steel Corp., Los Angeles, Cal	Interior	Gate hoists	82,000
American Automatic Electric Sales Co., Chicago, Ill	Signal Corps	Telephone equipment	81,626
Wallace & Tiernan Products, Inc., Belleville, N. J	Signal Corps	Lamp mountings	157,164
Cincinnati Shaper Co., Cincinnati, Ohio	NACA	Press brakes	$16,269
National Broach & Machine Co., Detroit, Mich	Ordnance	Profiling machines	24,960
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	Air Corps	Engine lathes	28,731
Plomb Tool Co., Los Angeles, Calif	Air Corps	Miscellaneous tools	62,896
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy, Ordnance	Lathes	86,536
Gisholt Machine Co., Madison, Wis	Navy	Turret lathes	17,301
American Tool Works Co., Cincinnati, Ohio	Air Corps	Lathes	123,873
E. W. Bliss Co., Brooklyn, N. Y	Ordnance	Heading press	61,250
Seneca Falls Machine Co., Seneca Falls, N. Y	Ordnance	Tool lathe	13,130

INSIDE DETROIT

Auto plants not being converted to manufacture munitions. Contracts for defense program projects not expected for six months. Normal production and model change-overs continue

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Contrary to a widely held popular notion that auto plants are being shut down for conversion to munitions manufacture, the prosaic truth is that only the normal model changeover is now in process. So far, only scattered and now insignificant educational orders have been placed in this area for shells and machine guns. A few thousand trucks have been built, but the Army's requirements for say 50,000 vehicles in the first year could be handled by any of several units without great effort.

It is a curious fact that political bigwigs and certain columnists know more about what the auto industry will be required to do as its part in the national defense program than the industry's leaders do themselves. And these gentry apparently seem to have a better idea of what will be required than those responsible for planning the gigantic procurement programs now in progress. Yet from what can be learned locally it appears that all of six months will pass before the scope of the national defense program can be determined and contracts be let.

Business Men Dismayed

Local business men have been dismayed to learn that the political and business viewpoints are still poles apart in respect to procurement of national defense items. They report that efforts have been made to dictate various aspects of the product to be made and the terms, but with no regard to the risks involved to the contractor. In some cases, it has appeared to these men that the design of the product has not been adequately tested, and that political considerations may have had a bearing upon the choice.

If the manufacturer takes such a contract against his better judgment and experience in making commercial material of somewhat similar nature, he assumes all risks without compensation. A large sum could be spent tooling up and the contract cancelled if the first samples did not measure up to the government's ideas. Besides the monetary loss involved, the manufacturer must consider his well-earned standing with the public. Even if he were in no wise responsible for the failure, it would be impossible to escape the blame. To make such propositions still more unattractive, the government is reported to have suggested profits in the order of two to four per cent, as compared with the seven per cent to be allowed on munitions contracts. This is hardly sufficient compensation for normal risks and smacks of a confiscatory attitude. Furthermore, there still exists an attitude of commanding that such and such be done overnight, without practical consideration of the difficulties attending the process of tooling up.

A change for the better in government-industry relations in respect to munitions contracts can be looked for when the former realizes: (1) that automobile production lines need not and can not logically be converted to munitions manufacture, (2) that it takes time to tool up idle facilities for production of any component in quantity, and (3) that amortization of equipment cost bears a close relationship to contract quantities, not visionary expectations.

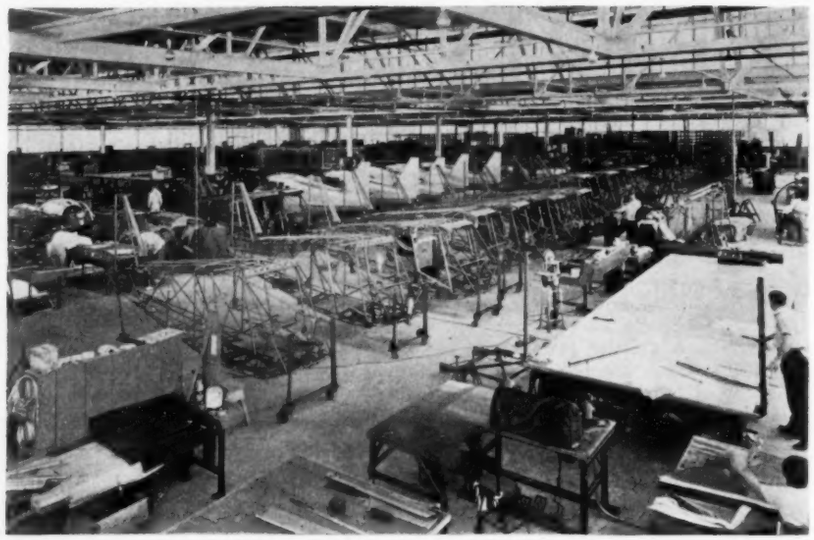
Meanwhile there has been no let-up in the work of estimating equipment needs and of planning production techniques for components that the government may logically ask local concerns to furnish. Ford is reported continuing activity on tooling methods for an aircraft motor and stands ready to produce it solely for American use when asked to do so. Chrysler has an ordnance division hard at work estimating certain items. Packard is ready to go on mass output of marine motors and possibly a related type of aircraft motor. But these projects can not become actualities until definite contracts are received.

But defense planning is only a small part of activity in the auto plants at the present time. Mill-

LOWDOWN ON HENRY FORD

DETROIT—There is no logical explanation for Henry Ford's throwing overboard the contract for Rolls-Royce engines. The best yet found is that Henry reserves the right to do what he wants, whether anybody likes it or not. He has always professed to hate war, and that probably had as much to do with his decision as anything. Those who think that Henry took an easy way out of trying to make good on an impossible promise (to deliver engines at a rate of 1,000 a month or better within six months) are probably wrong. Ford has done much work on simplifying the Rolls engine over the past two years and may yet build it solely for U. S. defense purposes.

Joins Heavyweight Class—*Diesel-electric locomotives will be used for the first time in main line freight work by Santa Fe. Electro-Motive Corp. will build two 5,400-hp. units similar to this one, which has been undergoing severe tests by various railroads since last November. While initial cost is about three times that of conventional engine, operating economies are said to offset this. Santa Fe is also buying ten modern steam locomotives, may get an answer to the steam vs. diesel-electric argument*



Down South—*Though ground for the Nashville, Tenn., plant of Stinson Division of Aircraft Manufacturing Corporation was broken only late last winter, the first commercial plane ever built in the state was recently completed in it. New plant cost $1,000,000, provides some 123,000 sq.ft. of manufacturing space. Above, Stinson 105's take shape*

wrights, engineers, and die shop personnel are the chief classes of employees in evidence in several independent plants that closed down at the end of June. Three GM divisions were scheduled to go down last week or this week. Some plants will reopen as early as July 17 after a shutdown of only two weeks. New models are likely to appear by August 10.

As asserted on previous occasions the chief modifications in 1941 models will center about extensive body changes. Observations in local die shops and in the auto plants bear out this contention. Generally speaking, styling for 1941 will follow the example set by GM's Torpedo models. Mechanical changes will not be extensive.

Heavy Outlay Needed for Dies

Die programs for the new wider and lower bodies involve the greatest outlay for dies and fixtures in recent years, yet additional money has been spent throughout the sheet-metal fabricating process in order to expedite assemblies, obtain a better product and lower costs. The dies themselves have been made more carefully, if anything, so that the stampings will more exactly follow the desired contour. Welding-machine fixtures have been planned with a view to easier loading and to produce more accurate assemblies. Metal finishing with file and hammer will largely be eliminated.

New practice calls for assembling sheet-metal components in the car position wherever possible and to do so upon fixtures with supporting surfaces that accurately duplicate the contours of the master model. For this reason, welding machine fixtures, punching machine fixtures and other equipment include elements that have been Kellered directly from the wooden or plaster models. Thus, these fixtures accurately duplicate the dies upon which the stampings were made, and hold and locate stampings without distortion.

The net result of spending more money on better dies and fixtures is a sub-assembly that more accurately fits the chassis or the body. This is especially important in regard to the front-end assembly. Fenders, grille, and apron will be assembled as a unit and dropped onto the chassis after the body, instead of being placed first as is now the common practice. Connections between the engine and body will be facilitated by the new final assembly method.

Sheet-metal fabrication lines will be shortened by employing welding machines capable of producing as many as 240 assemblies per hour. The merry-go-round method of fabrication with gun welders is apparently already out of the picture in certain shops.

G.M. Diesel Division Expands

By the first of the year the Detroit Diesel Engine Division of General Motors will have in operation a new 600x280 ft. addition that will double its present productive capacity of 3,000 small engines yearly. The product of the Detroit plant goes to a variety of outlets and consists of one, two, three, four and six-cylinder models ranging from 15 to 165 hp. It is understood that the new addition is required solely for expanding commercial business and is not predicated upon anticipation of national-defense needs.

Considerable steel tonnage has been placed for 1941 models, but local vendors regard present orders as conservative. Deliveries are being maintained on a ten-day to three-week basis because the mills were able to anticipate demand better than prior to the swift upsurge last fall. Prices remain unchanged. Apparently there is no fear that prices will be raised, or else buyers would be stampeding the market. It will be remembered that the government turned thumbs down on a price increase a year ago.

Auto dealers are moving present stocks with the threat of a price increase next year, and manufacturers apparently condone the practice as smart merchandising. But if steel does not go up, and other commodity prices do not get out of line, it may be argued that there will be no appreciable price advance on 1941 models. At the present time auto plants anticipate a good 1941 season because of increased spending brought about by the national-defense program. Competitive reasons may prevent taking advantage of the market.

TVA CREATES INDUSTRIAL SITES

WASHINGTON—Defense Commission's request for $25,000,000 to start a $65,000,000 expansion of TVA power supplies was turned down by a Senate committee. But with the Stettinius prestige behind it, there is little doubt that the proposal will go through on a second try. In any case it is a clear indication that the Defense Commission has its eye on the Tennessee Valley as a site for defense industries. The Commission may also be interested in the Columbia Valley and the Grand Coulee Dam.

A.S.T.E. ADDS TWO MORE CHAPTERS

DETROIT—The American Society of Tool Engineers recently started two new chapters, one at Columbus, Ohio and the other at Indianapolis, Ind. This increases the chapters to 37.

Officers of the Columbus Chapter No. 36 are: Chairman, R. J. Freter, chief engineer, Columbus Bolt Co., chairman; C. E. Nelson, supervisor of tools, the Jeffrey Mfg. Co., vice-chairman; S. J. Matchett, Jr., engineer, Ranco, Inc., secretary; H. M. Poole, instructor in industrial engineering, Ohio State University, treasurer.

The Indianapolis Chapter (No. 37) elected the following: Chairman, H. D. Hiatt, Allison Engineering Co.; vice-chairman, Ronald Updike, chief tool engineer, Schwitzer Cummins Co.; secretary, R. D. Harris, chief designer, International Harvester Co.; treasurer, D. H. Chancellor, Prestolite Co.

WATCHING WASHINGTON

Billions voted in defense spending spree. Government funds to finance new arms plants. Biggest choke point is getting orders out. President will give Knudsen his complete backing

BY BLAINE STUBBLEFIELD

WASHINGTON—Billions are being authorized or appropriated for defense so rapidly by Congress that it makes one dizzy trying to keep up with the latest action. As an example, the first deficiency bill gave the Army $732,000,000, including a $200,000,000 blank check to the President. The second deficiency bill provides an additional $1,030,000,000 for the War Department. Now along comes Mr. Roosevelt with an army program which will need an additional $3,000,000,000 to $5,000,000,000. The new billions are to be used to produce equipment for an army of 2,000,000 men "just in case." The Army would like to see that much equipment on hand by August, 1941, but to a practical observer that date seems optimistic.

Tens millions of dollars will go for construction of new munitions-making plants. Where they will be located is not known, but one thing is sure: many of them will be in the interior. In some cases, factories will be financed and operated exclusively as a government venture. They will produce only highly specialized war products. In other cases, the government will furnish the money with which to build the plant and to buy all the machinery, but will turn over the operation to private manufacturers.

There is still a third policy. The government is permitted, according to a bill just passed, to advance 30 per cent on a munitions contract to enable a supplier to build additional capacity or to tool up extensively if such action is necessary and the size of the order warrants it. Arrangements have been made for the RFC to loan money to suppliers, but in most instances suppliers are able to secure all the finances they need from their regular banking sources. The administration still hates to make any concession in quick write-offs of plant and equipment, though the War Department long has wanted such provision.

Capital the Choke Point

So far as choke points are concerned in the defense program, various government agencies point to a number of them: smokeless powder making facilities, armor plate capacity, big gun and small arms and ammunition production, high horsepower aircraft engines, trucks and tractors (including tanks), tool and die making capacity, and machine tools. Many of these choke points may not turn out to be choke points at all, but both the Army and Navy are watching them. Meanwhile the choke point at the moment is Washington itself. Manufacturers cannot start tooling up for munitions manufacture until they know what they are tooling up for. Some officials express the fear that the whole program may be needlessly delayed because red tape won't be cut fast enough. They say that certain departments are contract-conscious rather than production-conscious and just can't pull themselves out of their old habits of waiting until every T is crossed and every I is dotted before placing orders. In justice it should be said that Mr. Knudsen's commission has moved with alacrity and has succeeded in getting many things done which normally would have taken much longer.

Chief—*Just in time to take the world's biggest shipbuilding job on his shoulders, Rear Admiral Samuel M. Robinson assumes duty as Chief of the Bureau of Ships. This bureau, newly created by Congress, combines the functions of the Bureau of Construction & Repair and the Bureau of Engineering. Admiral Robinson was born in 1882, attended the Naval Academy, made a distinguished career in naval ship design. It was the forward-looking ex-Secretary of Navy Charles Edison who pushed the reorganization through Congress. This is the first change in the Navy Department since organization of the Bureau of Aeronautics in 1921.*

PACKARD GETS FORD CONTRACT

WASHINGTON — The Packard Motor Co. has agreed to take over the Rolls Royce engine contract which was previously to be filled by the Ford Motor Co. Packard will build 3,000 engines for the United States and 6,000 for Great Britain. Packard's president Gilman says production will start in ten months at 20 units a month, reaching 840 a month after fifteen months.

General Motors Steps Up

While Henry Ford wallows in a morass of scathing criticism from the Army, Navy and administration for his attitude, General Motors has stepped into the defense situation in a big way. Its boss, Bill Knudsen, heads all defense activities in Washington. Its former export chief, Jim Mooney, has been assigned the task of expediting all defense business assigned the corporation. General Motors undoubtedly is on the list to share sizeable armament orders. Already Chevrolet has educational orders for forging and machining shells and Saginaw Steering Gear for making Browning machine guns. But those are only the beginning.

Knudsen Plans Long Stay

One astute observer says, "National Advisory Defense Commission headquarters and set-up begin to resemble NRA, and if you'd check up, you would find a considerable number of NRA payrollers already holding down defense jobs." Perhaps so. Admittedly, the President has appointed a number of New Dealers to minor capacities with Knudsen, Stettinius & Co. And it is known that confirmed Left Winger Leon Henderson is dabbling into defense affairs which are no concern of his (and of which his ignorance is abysmal). Nevertheless, the President is giving Bill Knudsen full backing. True, Mr. Knudsen's honeymoon period in Washington is hardly over. He has taken a house on Washington's outskirts for three months, already is worrying over a place to live after that time is up.

U.S. Embargo on War Materials May Cut Nippon Plant Expansion

TOKYO—The curtailment and possible embargo of export shipments of machine tools and "implements of war" may seriously affect many Japanese industrial expansion plans, according to the *Nippon Kogyo Shunbun*. On the assumption that machine tools could be obtained from the U.S. the Niigota Iron Works, one of the "big six," recently doubled its capitalization to $10,000,000 to obtain funds for the enlargement of its Niigota, Kashuwazaki, Urawa, and Kamata plants. Among other expansion projects which may be affected are: The Ishikawajima Shipbuilding Company's aero-engine plant, the Tokyo Automobile Company, the International Industrial Company and the Manchu Aircraft Company's aeronautical plants, and the Manchu Automobile Company. It is partly due to the events in Europe that these companies have all come to depend upon imports from the U. S.

Machine Tools Vital

The Shibaura-United Industrial Company, in which General Electric and United Engineering & Foundry have an interest, may not be in a position to continue its plans for large-scale production of rolling mills should additional tool orders from the U. S. be embargoed.

In Tokyo the Army and Navy Planning Board and the Commerce-Industry Ministry are reported to have decided on joint action to reorganize the home machine tool industry on a new basis in the event that a total embargo on machine tool exports from the U. S. materializes. A complete socialization of the Japanese machine tool industry may be effected. Japanese law provides for the expropriation of foreign patents in case their exploitation in Japan is deemed necessary for national defense.

Vanishing Market—*Japanese machinery imports aren't what they used to be, but what business there is U.S. manufacturers have lately had to themselves. Now a machine tool embargo may seriously curtail Japanese plant expansion, typified by the installation of this 900-ton forging press*

$100,000,000 ARMS EXPORTED

WASHINGTON—From the State Department comes the announcement that a total of $100,063,870.68 worth of arms, ammunition, and implements of war have been exported from the United States during the year 1940, including May. The largest buyer of war materials was France with $53,712,110.50; Great Britain was second with $13,335,081.15; Australia was third with $8,472,739.62. Other heavy buyers were: Finland, $5,096,837; Canada, $2,657,524; China, $2,421,758; Netherlands East Indies, $2,349,644; and Turkey, $1,705,800.

Marked Expansion of Shipyards On Government Defense Program

WASHINGTON—Expansion of shipyards will be the next big thing on the defense program. Admiral Emory S. Land has been appointed coordinator of shipbuilding for the Defense Commission in preparation for large-scale construction of yards and ways and rehabilitation of old ones; $150,000,000 has been appropriated for this purpose.

The Maritime Commission says 24 yards are building ocean-going vessels. About 18 have contracts for Navy or Commission ships. Many of these jobs are contracted up to capacity. It is estimated there are 60 ways that would take combatant vessels while Navy has money to build 140 ships right away. Ten battleships and five carriers are scheduled for immediate building, but experts believe that existing facilities will handle only twelve of the fifteen. Space is available for only seventeen light cruisers, whereas funds are provided for twenty-five. There are other serious shortages of building space. On top of the Navy program, the largest ship construction job in history, is the Merchant Marine schedule of 50 ships a year for ten years.

U. S. Government Defense Contracts Awarded to Metal-Working Firms

(Other Metal-Working Contracts on Page 517f)

Contractor	Gov't Agency	Commodity	Amount
Baldwin Locomotive Works, Eddystone, Pa.	Ordnance	Shell forgings	$240,272
Gilbert & Barker Mfg. Co., Springfield, Mass.	Ordnance	Rifle parts	23,701
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.	Ordnance	Shell forgings	123,759
Stockham Pipe Fittings Co., Birmingham, Ala.	Ordnance	Machined shells	69,957
Wheland Co., Chattanooga, Tenn.	Ordnance	Machined shells	66,758
Standard Pressed Steel Co., Jenkintown, Pa.	Ordnance	Primer heads, bullet cores	320,560
Consolidated Steel Corp., Los Angeles, Calif.	Ordnance	Demolition bombs	109,626
Omaha Steel Works, Omaha, Neb.	Ordnance	Machined shells	161,658
Colorado Fuel & Iron Corp., Denver, Colo.	Ordnance	Shell forgings	251,674
Key Co., East St. Louis, Ill.	Ordnance	Machined shells	164,205
W. C. Norris Mfgr., Inc., Tulsa, Okla.	Ordnance	Machined shells	76,689
Chrysler Corp., Detroit, Mich.	Ordnance	Cartridge cases	154,082
Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.	Navy	Airplane parts	11,458
United Aircraft Corp., Hamilton Standard Propellers Div., East Hartford, Conn.	Navy	Speed control units	17,540
Precision Mfg. Co., Philadelphia, Pa.	Ordnance	Telescope mounts	68,120
Sperry Gyroscope Co., Brooklyn, N. Y.	Ordnance	Computing sights	25,000
Bausch & Lomb Optical Co., Rochester, N. Y.	Ordnance	Stereoscopic trainers	15,227
Stanley G. Flagg & Co., Philadelphia, Pa.	Navy	Tube fittings	40,222
Walworth Co., New York, N. Y.	Navy	Tube fittings	103,474
Kingston Products Corp., Kokomo, Ind.	Ordnance	Machined shells	45,062
Darling Valve & Mfg. Co., Williamsport, Pa.	Ordnance	Machined shells	58,902
Mergenthaler Linotype Co., Brooklyn, N. Y.	Ordnance	Airming circles	128,953
Mattatuck Mfg. Co., Waterbury, Conn.	Ordnance	Primer bodies	18,000
Chicago Screw Co., Chicago, Ill.	Ordnance	Cartridge containers	10,098
Dictaphone Corp., Bridgeport, Conn.	Signal Corps	Code transmitter	14,250
Grumman Aircraft Engineering Corp., Bethpage, N. Y.	Navy	Aircraft axles	15,882
Curtiss-Wright Corp., Curtiss Aeroplane Div., Buffalo, N. Y.	Navy	Airplane parts	12,311
Douglas Aircraft Co., Santa Monica, Calif.	Air Corps, Navy	Gun sights, plane parts	127,213
Pioneer Instrument Div., Bendix Aviation Corp., Bendix, N. J.	Navy	Aircraft instruments	59,800
Spencer Lens Co., Buffalo, N. Y.	Navy	Telescopic alidades	40,596
U. S. Machine Corp., Lebanon, Ind.	Ordnance	Machined shells	35,155
Chevrolet Motor Div., General Motors Corp., Detroit, Mich.	Ordnance	Machined shells, forgings	136,977
Federal Screw Works, Chelsea, Mich.	Ordnance	Detonator sockets	36,870
General Iron Works Co., Denver, Colo.	Ordnance	Machined shells	115,455
National Pneumatic Co., Rahway, N. J.	Ordnance	Guns	1,412,227
Hobart Mfg. Co., Troy, Ohio	Ordnance	Telescope mounts	46,099
General Electric Co., Schenectady, N. Y.	Ordnance	Howitzers	552,834
Midvale Co., Philadelphia, Pa.	Ordnance	Gun barrels	428,736
Scovill Mfg. Co., Waterbury, Conn.	Ordnance	Cartridge cups	43,450
American Brass Co. Torrington, Conn.	Ordnance	Cartridge cups	79,300
Eastman Kodak Co., Rochester, N. Y.	Ordnance, War	Telescopes, aiming circles	138,977

NAMES in the NEWS

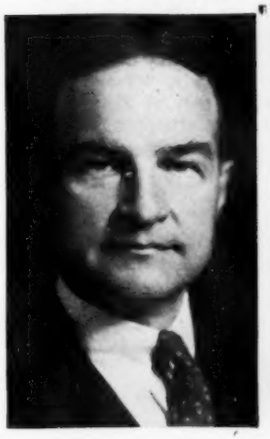
Irving S. Olds has been elected chairman of the United States Steel Corp., Pittsburgh, Pa. He succeeds Edward R. Stettinius, Jr., who has resigned to serve as a member of the recently appointed National Defense Commission.

A director and a member of the Finance Committee of U.S. Steel since 1936, Mr. Olds was born in Erie, Pa., in 1887. He graduated from Yale in 1907 and from Harvard Law School in 1910, and was admitted to the bar in Pennsylvania in 1910 and in New York in 1912. He was secretary to Mr. Justice Holmes of the United States Supreme Court from 1910 to 1911, becoming connected with White & Case of New York in 1911, admitted as a partner in 1917. For the next two years Mr. Olds served as counsel for the purchasing department of the British War Mission to the United States, and in 1918 was a special assistant in the U.S. War Department. Since 1919, he has been engaged in legal work related to matters of organization and administration of corporate business enterprises.

Robert Urquhart, since 1914 employed at the Homestead steel works of Carnegie-Illinois Steel Corp., Pittsburgh, Pa., has been appointed assistant general superintendent in charge of operations. He is succeeded by Walter F. Nicoden as superintendent of open hearth departments. Warren W. Scherer has been appointed superintendent of maintenance, and Fred C. Frame has been named to Mr. Scherer's former position as superintendent of industrial relations at the company's Irvin works.

Andrew Heilman has been named president and manager of Tiffin Gray Iron & Semi-Steel Co., Tiffin, Ohio.

U. S. Steel Chairman *Advancing, Retiring, in Canton Roll & Machine*



IRVING S. OLDS

HAROLD P. INGRAM

WILLIAM A. HARRIS

Harold P. Ingram has been appointed general superintendent of the Canton Roll & Machine Works, Canton, Ohio, according to an announcement by Carnegie-Illinois Steel Corp. He succeeds William A. Harris, who is retiring after 34 years of continuous service with subsidiary companies of United States Steel Corp.

Mr. Ingram was born at Homestead, Pa., in 1898. He attended Carnegie Institute of Technology, and began his industrial career in the engineering department of Westinghouse Electric & Mfg. Co. at East Pittsburgh in 1913. Two years later he entered the roll department of Homestead works as an apprentice, and from 1920 until 1928 was employed as a draftsman. From that time until 1937 he was superintendent of the Homestead roll department. He has been superintendent of maintenance at Homestead works since 1938.

Mr. Harris was born in Niles, Ohio, in 1871, and received a degree in mechanical engineering from Cornell University in 1893. He entered the sheet steel industry that year and became associated with U.S. Steel subsidiaries at the American Tin Plant as assistant chief engineer in 1900. From 1902 until 1906 he was secretary and chief engineer of Lewis Foundry & Machine Co., at which time he went to Canton as manager of the Roll & Machine Works for American Sheet & Tin Plate Co. Upon merger of the sheet and tin plate company with Carnegie-Illinois in 1936, Mr. Harris became works general superintendent.

Courtlandt S. Gross has been elected president of Vega Airplane Co., Burbank, Calif., subsidiary of Lockheed Aircraft Corp. He succeeds Mac Short, who has been named vice-president in charge of engineering.

George M. Hunter, vice-president in charge of manufacturing operations for American Bridge Co., Pittsburgh, Pa., has retired with a service record of 51 years with the company. Frank K. McDanel, associated with the organization since 1904, succeeds Mr. Hunter.

Harry K. Clark has been elected vice-president and general manager, and Andrew B. Holmstrom has been named vice-president and works manager of the Norton Co., Worcester, Mass.

These appointments fill vacancies caused by two resignations. Aldus C. Higgins, president, who also held the office of general manager, has resigned the general managership, and George N. Jeppson, treasurer and vice-president, who also held the position of works manager, has resigned as works manager. Mr. Higgins will continue as president, and Mr. Jeppson will retain the offices of treasurer and vice-president.

Mr. Clark has been with Norton for 25 years, having served as salesman, Chicago district manager, sales manager of the company's plant in Germany, sales manager of the Abrasive Div., general sales manager, a director, and vice-president. He is also executive officer in charge of Norton Co. of Canada, Ltd., a director of

Promoted by Norton

ANDREW B. HOLMSTROM

HARRY K. CLARK

Behr-Manning Corp., and a director of Australian Abrasives (Pty.) Ltd.

Mr. Holmstrom has been connected with the company for twenty years, having had considerable experience as an engineer and in plant management. After five years in the Norton plants engineering department, from 1920 to 1925, he was appointed superintendent of sewers of the city of Worcester, when the city was installing a large sewage purification plant. When the plant was completed he returned to Norton, later going to England as resident engineer of the Norton Grinding Wheel Co., Ltd. Two years later he returned to Worcester, but in 1934 went back to England as general manager of the British plant. He again returned to America in 1939 to become works manager of the Abrasive Div.

August H. Tuechter, president Cincinnati Bickford Tool Co., Cincinnati, Ohio, will complete 55 years of service with the company July 13.

PLANT EXPANSION

George H. Alexander Machinery Ltd., Birmingham, England, in conjunction with McKenna Metals Co., Latrobe, Pa., has organized Kennametal of Canada, Ltd., for manufacturing Kennametal for Canada and the British Dominions. The main office and factory will be in Hamilton, Ont. Philip M. McKenna is president of the firm, and Arthur H. Alexander of Victoria, British Columbia, has been named general manager.

The Bullard Co., Bridgeport, Conn., has embarked upon its second important expansion move within a month. Contract has been awarded to Turner Construction Co. for erection of a 175x100-ft. machine shop.

Green Bay Drop Forge Co., Green Bay, Wis., is planning erection of a $4,000 steel treating plant.

Vultee Aircraft, Inc., Downey, Calif., is embarking upon a plant expansion program which will involve nearly $3,000,000.

Waterbury Tool Co., Waterbury, Conn., has awarded contract to the Austin Co. for an addition which will add 23,000 sq.ft. of manufacturing space. In the future the company will be known as the Waterbury Tool Div. of Vickers, Inc., of Detroit, Mich. The Detroit parent company is also building an addition which will cost approximately $500,000.

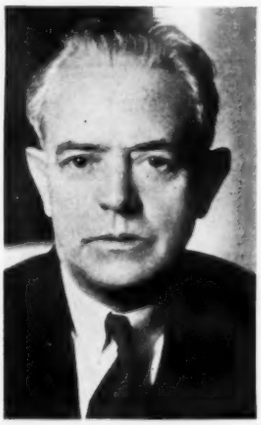
H. G. Weber Co., Kiel, Wis., paper bag machinery maker, is erecting a new plant addition.

OBITUARIES

Louis E. Murphy, formerly president and chairman of E. F. Houghton & Co., Philadelphia, Pa., died June 26 at his summer home at Mantalocking, N. J., following a short illness culminated by double pneumonia. He was 66 years of age.

Mr. Murphy had been connected with the Houghton organization for

Former Houghton Head Passes



LOUIS E. MURPHY

52 years, having started as an errand boy in 1888. He was elected secretary of the company in 1910 and vice-president in 1914. He became president in 1929, and chairman in 1934. After his resignation in 1936 he continued as a director up to the time of his death.

Walter C. Doering, 53, vice-president American Steel Foundries and former vice-president of Bradford Corp., railroad equipment manufacturer, died June 21 in St. Louis, Mo.

Daniel W. Hobbs, 87, former superintendent at the Yates-American Machine Co., Beloit, Wis., died May 30.

Harold G. Pederson, 46, president Pederson Tool & Cutter Co., Milwaukee, Wis., and widely known as the inventor of Pedwyn balancers, died in that city June 16.

John Prentice, 67, superintendent of the Bayone, N. J., plant of Babcock & Wilcox Co., New York, N. Y., died June 30 following a short illness. He had been with the company since 1898.

Edward R. Sargent, 84, former director and official of Sargent & Co., New Haven, Conn., died suddenly June 20.

Jeremiah F. Shea, 53, for fifteen years president Shea Foundry & Machine Co., Bridgeport, Conn., died June 26.

John P. Togstad, 58, superintendent Ben H. Anderson Mfg. Co., Madison, Wis., died June 12.

BUSINESS ITEMS

Allegheny Ludlum Steel Corp., Pittsburgn, Pa., has appointed Murray-Baker-Frederic, Inc., New Orleans, La., as distributor for its line of tool steels.

Belmont Radio Corp., Chicago, Ill., has purchased one unit of the former Grigsby-Grunow Co. plant in that city.

Louis E. Emerman & Co., Chicago, Ill., used machine tool dealer, has purchased Davis - Thompson Co., Milwaukee, Wis., manufacturer of automatic production machinery. Operations will be continued in Milwaukee under the same corporate name with new owners of the firm producing machine tools for the automotive industry under patents owned by Frank M. Davis. The plant will be in charge of William H. Weimer, with the company since 1911, who will serve as vice-president and general manager. C. L. Nelson will be president, and Mr. Davis will become chairman of the board.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has changed the name of its Ashcroft American Gauge Division to Ashcroft Gauge Division.

Thomas C. Wilson, Inc., Long Island City, N. Y., has moved its offices and factory to larger quarters at 47-28 37th St.

MEETINGS

American Institute of Electrical Engineers. Pacific Coast convention, Los Angeles, Calif., Aug. 26–30.

National Foreign Trade Council. Twenty-seventh national foreign trade convention, San Francisco, Calif., July 29-31.

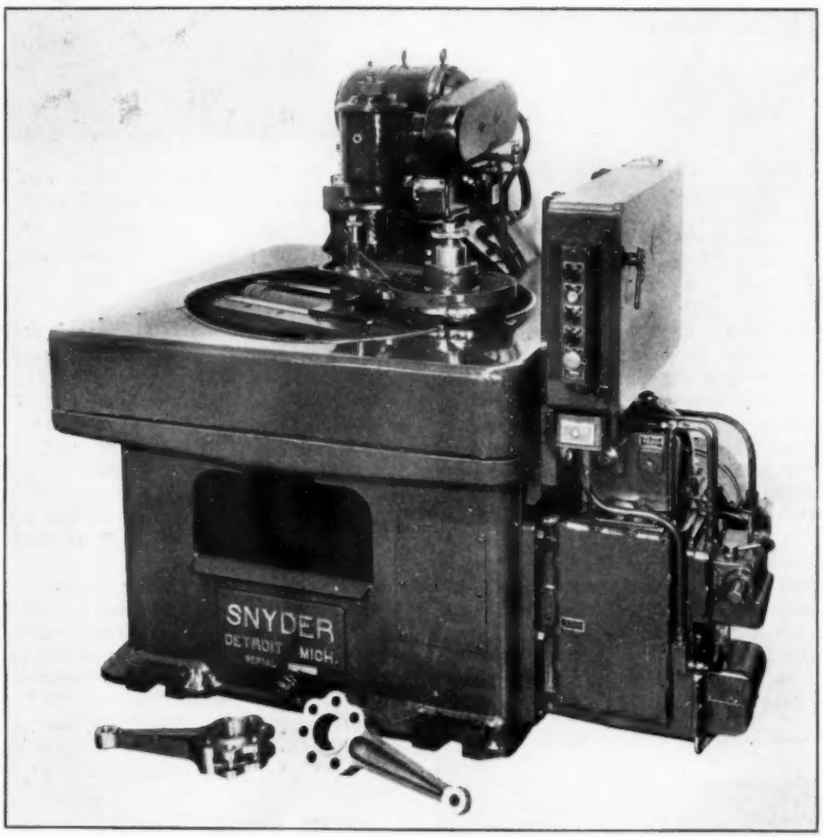
Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill., Oct. 16–18.

Silver Bay Conference on Industrial Relations. Twenty-third annual meeting, Silver Bay on Lake George, N. Y., July 24–27.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24 and 25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

SHOP EQUIPMENT NEWS

Special Snyder Contour Milling Machine Developed for Finishing Master Rods



High nickel-chrome master rods for a foreign aircraft engine will be contour milled complete in 30 min. on a special contour miller built by the Snyder Tool & Engineering Co., 3400 East Lafayette St., Detroit, Mich. The machine also is suitable for articulated rods and other contour milling operations of similar nature by merely changing the master cam located below the work-table fixture plate. The heat-treated master rod is located on the fixture from two drilled holes in the large and small bosses. After pressing a button, an automatic cycle involving four distinct work movements is secured. The contour of the rod is completed with all cuts blended together.

In the first position of the work table and work slide, the center of the small boss lies on the center of work table rotation. The cutter head is fed to depth hydraulically, after which the work table rotates at the proper feed through an arc of 142 deg.

At the second position work rotation is stopped, and the slide moves to the right to mill one side of the rod. The slide is moved by an hydraulic cylinder operating under pressure of 1,800 lb. per sq.in. The cutter head is being urged toward the work by a 300 lb. per sq.in. circuit so that its roller is pressed firmly against the master cam. Thus, when the more powerful slide moves the master cam past the cutter head roller, the cutter head advances or retreats with the master cam outline.

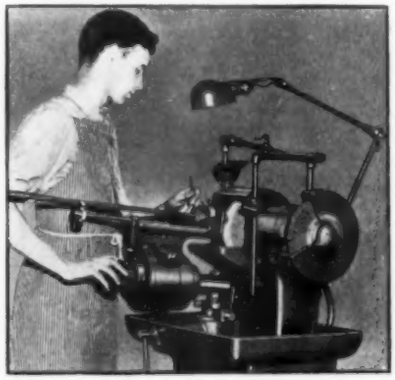
At the third position the slide has moved so that the center of the large boss coincides with the center of the work table. Point slide movement is arrested and the work table is revolved 218 deg. The fourth position is reached, the work table rotation is stopped, the slide again moves to the right to mill the opposite side of the rod, finally finishing at the original starting point.

Slide movement and work table rotation are cut on and off as required by limit switches fixed to the periphery of the work table. These switches can be adjusted so that there is no overlap or gap in the respective motions, resulting in blended cuts. The work table is driven by a double worm and wheel arrangement that eliminates any tendency toward backlash.

Pratt & Whitney Grinder Made for Deep Hole Drills

A machine for sharpening deep hole drill tips has been developed by Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn. This compact deep hole drill sharpener will take drills from 3/16 to ⅝ in. diameter inclusive. The roughing, finishing, and general purpose grinding wheels all are driven directly by a 1/3 hp. motor. The coolant system consists of a pump and 1/6 hp. motor mounted at the rear of the pedestal, suitable piping for all wheels, and a coolant reservoir inside the pedestal with provision for removing sediment and draining.

The drill to be sharpened is inserted in a drill bushing and cam mounted on the rocker. Four removable bushings and cams of different sizes and pitches are furnished with the machine. The surface on the face of the cam contacts a cam abutment to



produce the correct helix and dwell positions. An adjusting nut at the front of the rocker feeds the entire rocker unit on a threaded shaft toward or away from the grinding wheel. This shaft is fastened to the elevating shaft, which provides vertical adjustment through a nut to obtain the desired relief at the cutting edge.

The rocker housing contains a worm shaft which, when rotated, swings the entire unit around a gear on the threaded rocker shaft. This furnishes

the means for moving from the roughing to the finishing wheel, and also acts as a sidewise feed while sharpening. The diamond for dressing the roughing and finishing wheels is mounted on the rocker. The entire rocker unit can be swiveled about the elevating shaft and bound in the desired position.

Provisions for step grinding are available, although it may require a slightly harder grinding wheel. Stepping the drill splits the chips and facilitates their passage through the chip groove in the shank of the drill. It also tends to make smoother holes and increases the life of the drill between sharpenings.

Oilgear Propeller Twisting Machine Corrects Inaccuracies in Pitch

The improved fluid power, variable speed propeller twisting machine manufactured by the Oilgear Co., 1302-A W. Bruce St., Milwaukee, Wis., is adapted for twisting 7 to 14 in. wide airplane propeller blades to correct inaccuracies in pitch. It permits the blades to be forged very nearly to the finished size so that only a small amount of stock need be removed during the machining operation. It will maintain the axis of the twist upon the longitudinal center line of the work piece. The machine, shown in Fig. 1, may be adjusted to make twists between various lengths, and will operate in either direction to increase or decrease pitch of a blade.

A simple pushbutton control of the hydraulic clamp is provided in the stationary and twisting supports. A hand lever with pilot follow-up control of the speed and direction of the twisting support movement. A Type DH-411 oil gear two-way variable displacement radial piston pump provides power necessary for both the clamping and twisting movement. Stationary and twisting clamp supports, Fig. 2, have integral clamping and unclamping cylinders. Fully-inclosed equalizer assemblies support twister clamp support and restrain side movement.

The propeller blade is loaded from the back of the machine and threaded through stationary clamp and twister clamp to the point to be twisted. The operator then depresses the pushbutton control and the stationary clamp closes on propeller blade under low pressure. If the blade is in the proper position, the operator depresses the other pushbutton and the twister clamp closes under low pressure. If the propeller is to be twisted clockwise, the hand lever is moved to the right. If the hand lever is moved to the left the blade is twisted counterclockwise. Pressure on the stationary and twister clamp automatically increases in direct proportion to the increase in pressure required to twist the blade. When the proper twist has been imparted, the pushbutton control again is operated to open the clamp.

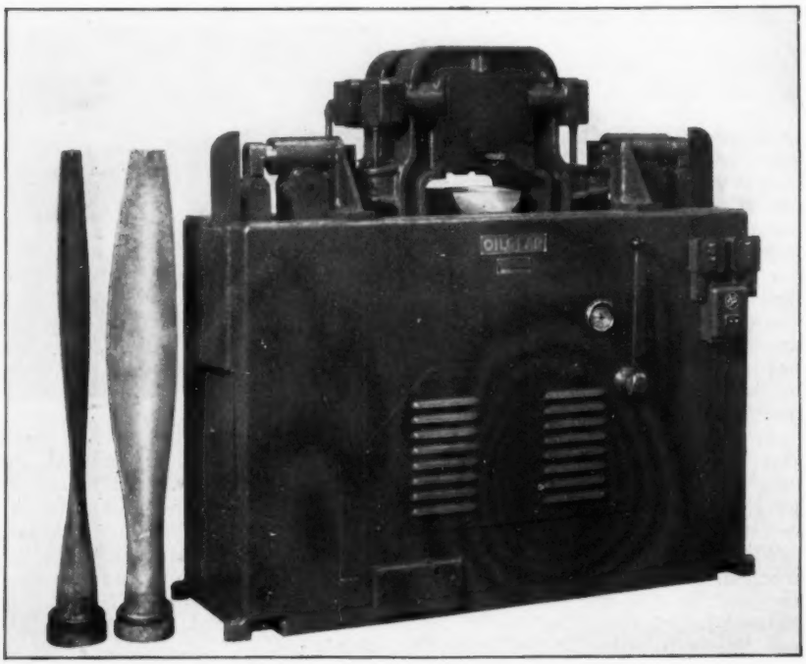


Fig. 1—Airplane propeller blades from 7 to 14 in. wide can be twisted in this machine to correct inaccuracies in pitch. The axis of twist is maintained on the longitudinal center line of the work

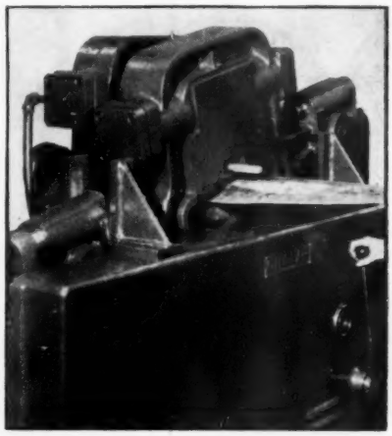


Fig. 2—Two pushbuttons and hand lever control all movements of this propeller twisting machine. All movements and clamps are operated hydraulically

When the hand lever is released the twister support automatically returns to a preset horizontal position on the same axis as the stationary clamp support. The propeller can be moved inward or outward to perform twisting operations on other sections of the blade. The center distance between stationary and twisting clamp can be varied from 7 to 10 in. so as to vary the length of twist.

This machine has a normal torque of 530,000 in. lb. and provides a twisting movement of 24 deg. (12 deg. either side). Height of work clamps above the floor is 56 in. Floor space required is 81 in. from right to left and 29 in. from front to back. The machine is 75 in. high.

Thomson Welding Press Is Widely Adaptable

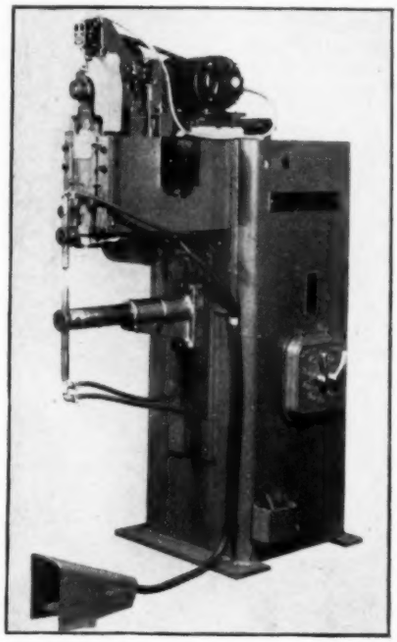
The interchangeability of essential parts on the 1940 Model No. 1 welding press offered by Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., makes it possible at any time to remodel the machine to suit new requirements with a minimum of labor and expense. For example, the machine may be purchased with a standard spring pressure head and then quickly converted to an air lock head type, or a machine with an apron mounted lower arm can readily be changed to a column mounted type or to a knee type machine for projection welding.

The fabricated steel frame is reinforced to minimize deflections under maximum loads prescribed by the Resistance Welder Manufacturers Ass'n. The transformer is completely inclosed and protected. Except for essential controls which are conveniently located, the sides of the frame are smooth. The flat sliding head moves with straight line action in

adjustable gibbed ways. Peel-off shims provide adjustment for wear. All bearing surfaces are lubricated by grease fittings located in plain view of the operator.

Sliding head is actuated by a special cam designed to slow down the electrode as it approaches the work, and so minimize electrode hammering. This cam action is said to be preferable to a toggle mechanism, since it involves fewer moving parts and because electrode contact is less severe. The head is returned by two compression springs which are concealed inside the neck.

A combination worm reduction and clutch unit running in an oil bath is



featured on this line of presses. Standard equipment includes a reliable limit switch for initiating current flow. This switch is closed and opened by accurately adjustable multi-leaf fan cams which can be used to time the welds directly to a contactor or through an auxiliary timing device. A variable speed pulley driven by a ½ hp. motor provides infinite speed selection between standard ranges of 36 to 109 or 44 to 133 strokes per minute. The press is designed to operate at electrode pressures up to 1,000 lb. This applies to units with 12, 18, 24 or 30-in. standard throat depths. Transformer ratings are 30, 40, 50 and 75 kva.

South Bend 10-In. Lathe Has 1-in. Collet Capacity

The Series S toolroom bench lathe, announced by the South Bend Lathe Works, 425 E. Madison St., South Bend, Ind., is recommended for precision operations on small work. This 10-in. swing lathe has a 1-in. maximum collet capacity. When mounted on the welded steel bench shown, the lathe is claimed to have the stability of a floor type lathe. Handwheels have been made large so as to reduce operator fatigue. Smooth operation at high

spindle speeds is achieved by using a direct belt drive to the balanced cone pulley and spindle assembly. Back gears provide slow spindle speeds with ample power for machining.

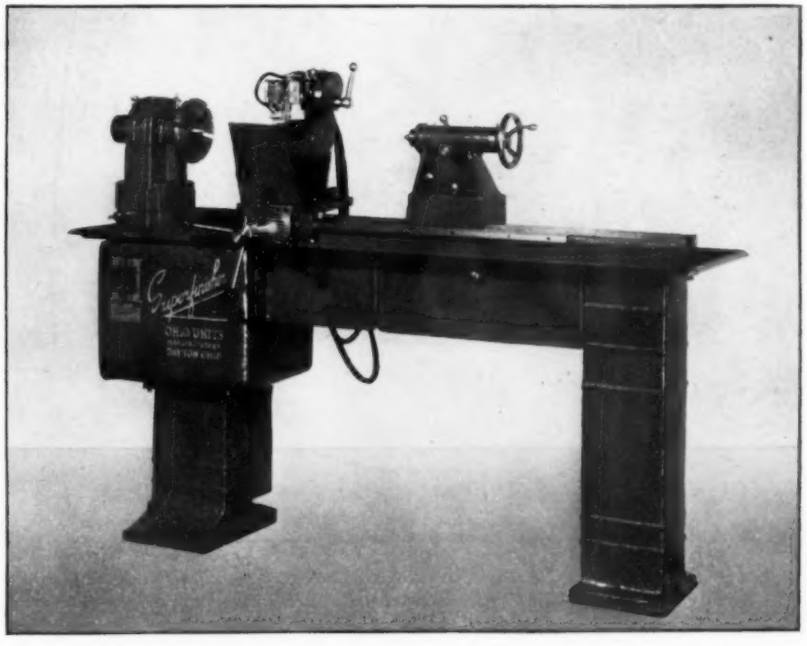
The headstock has 1⅜-in. capacity through the spindle and can be equipped with either hand lever or handwheel type draw-in collet chuck. Twelve spindle speeds ranging from 50 to 1,357 r.p.m. are provided by the standard motor drive equipment. Special drives are available where higher spindle speeds are necessary. A quick change gear mechanism provides power longitudinal carriage feeds from 0.0015 to 0.0836 in., power cross feeds from 0.0006 to 0.0313 in., and a series of 48 right and left-hand screw threads from 4 to 224 per inch.

Power carriage feeds are operated by a worm drive and a series of precision cut steel gears in the apron which run in a bath of oil. The power feeds are controlled by a multiple disk friction clutch which may be engaged or disengaged quickly. The carriage is equipped with a graduated compound rest which may be swiveled to any angle and locked for turning or boring bevels and tapers. This lathe is made in 3, 3½, 4 and 4½ ft. bed lengths, providing up to 34⅝ in. between centers. A telescopic taper attachment included as standard equipment makes it possible to change quickly from straight to taper turning or boring without disengaging the cross feed nut.

Ohio Units Superfinishing Machines Designed for General Shop Use

Designed to take care of almost any type of surface to which superfinish can be applied, a superfinisher suitable for general shop use has been made available by Ohio Units, 515-531 Hunter Ave., Dayton, Ohio. It is suitable for use in toolrooms, experimental departments and for small production runs. Round and flat, external and internal surfaces can be superfinished on this machine.

The No. N-301 universal superfinisher shown has an oscillating head which carries the superfinishing stones. This head is mounted on a carriage which may be manually traversed to permit the stones to come in contact with the full length of the



work. The head may be adjusted quickly to any position required, depending on the size of the work, and is driven by a flexible shaft from the main motor. Tension of the stones against the work is controlled through a spring adjusting device which may be changed instantly.

A gear type pump with a capacity of 1½ gal. per min. is mounted in the base, together with its driving motor. From this pump a steady stream of lubricant is delivered to the work through a flexible tube connection. The pump is equipped with an internal release valve so that the flow may be adjusted to any capacity desired. Suitable fittings are supplied for connecting to stone holders.

Capacity of the machine shown is 14 in. swing over the bed with 11 5/16 in. swing over the carriage. A raising block is available for the headstock and the tailstock, increasing these capacities to 17⅞ in. swing over the bed and 15½ in. swing over the carriage. The tailstock center has a travel of 4⅜ in. Length between centers is 14 in. on the standard machine. This can be increased to 63 in. on special order. The carriage is arranged for manual traverse through a rack and pinion drive. It has an adjustable stop which may be set to limit the travel and prevent the stones striking shoulders or flanges on the work. Over-all dimensions of the standard machine are 22 x 78 x 56 in. high.

Baldwin-Omes Shell Forging Presses Combine Mechanical Piercing and Drawing

Manufactured in the United States by Baldwin-Southwark Div., the Baldwin Locomotive Works, Philadelphia, Pa., under exclusive license from Omes-Continental, Holland, Baldwin-Omes shell forging presses are available in three sizes for shell forgings from 40 to 180 mm. The machines are compact and can readily be converted to standard universal forging machines when desired.

In the operation of these machines a heated square-section billet is inserted into the opened split die. This billet rests on a lower surface of the die, which is closed by compressed air under pedal control. After the die is closed a piercing mandrel operated from the crankshaft enters the hot square section billet and expands the material towards the walls of the die. When the die is opened the pierced shell forgings fall clear.

For shell forgings up to 125 mm. the drawing machine is built on and combined with the piercing machine, whereas in the case of larger shells, for reasons of greater efficiency, the drawing machine is separated from the piercing machine. After the drawing operation the shell forging is complete with inside finish bore requiring no internal machining and with a minimum machining allowance on the outside.

In order to increase the capacity of these smaller machines a number of piercing mandrels and dies and drawing mandrels are provided so that the piercing mandrel and drawing mandrel can be used in rotation. This reduces wear and gives the mandrel time to cool, thus prolonging the life of the tools and dies.

Design of these units is different from that of the conventional type of horizontal forging and upsetting machine, in that a horizontal throwing machine is coupled to the crankshaft and is operated simultaneously with the piercing part of the machine.

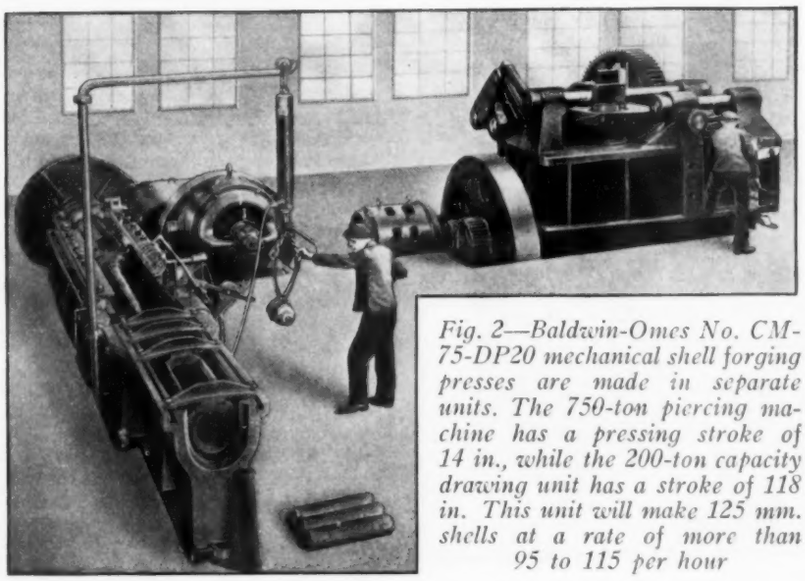


Fig. 2—Baldwin-Omes No. CM-75-DP20 mechanical shell forging presses are made in separate units. The 750-ton piercing machine has a pressing stroke of 14 in., while the 200-ton capacity drawing unit has a stroke of 118 in. This unit will make 125 mm. shells at a rate of more than 95 to 115 per hour

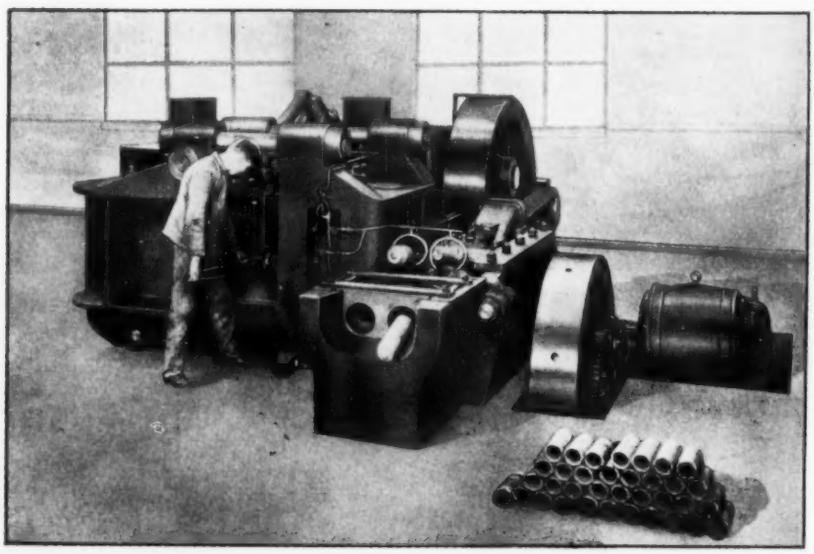


Fig. 1—The No. CM-50 unit combines a 500-ton piercing machine and a 200-ton drawing machine. Made by Baldwin-Southwark, these machines readily can be converted to standard universal forging machines

Since the dies, when closed, are circular, the use of a square billet means that the billet is squeezed at its four beveled corners when the jaws close. In the die there is a bushing of high grade steel which guides the mandrel, and since only linear motion takes place the mandrel enters the square section billet center, thus producing a concentric shell. When the machines are used for forging, the drawing unit is merely uncoupled from the crank pin of the driving wheel.

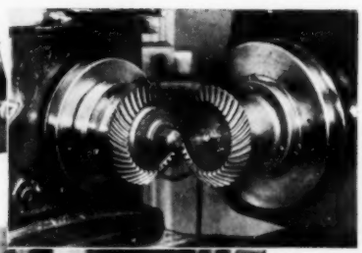
The smaller No. CM-35 unit is used for the manufacture of shells ranging in size from 40 to about 75 mm. Fitted with three piercing and three drawing mandrels, it requires an 85 hp. motor. The No. CM-50 unit shown in Fig. 1 manufactures shell forgings from 75 to 125 mm. (3 to 5 in.). Like the CM-35 unit, it combines a piercing machine and a drawing machine. The CM-50 machine has a pressing stroke of 14

To Assure PRECISION GEARS...

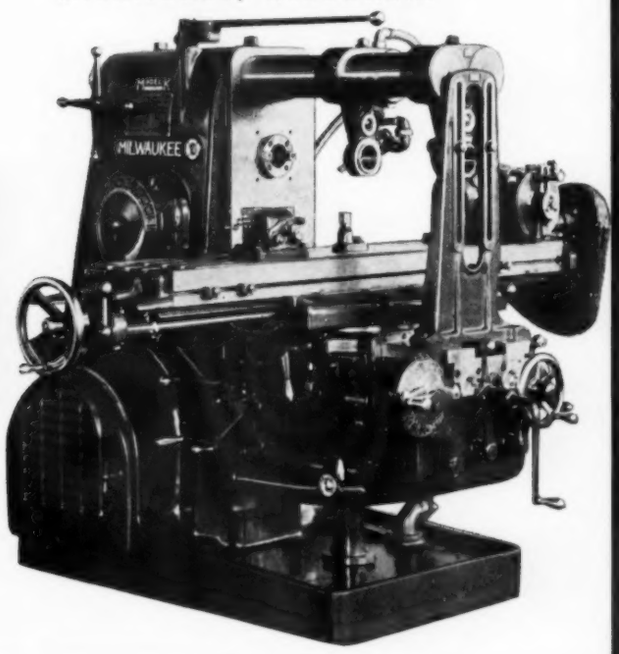
for MILWAUKEE MILLING MACHINES ...TWO COMPLETELY EQUIPPED GEAR LABORATORIES

PRECISION gears are vital to the sustained accuracy and performance of milling machines. Cut to exacting tolerances by the finest and most complete equipment obtainable, gears for Milwaukee Milling Machines must, in addition, pass precision tests for profile, lead, bearing, involute, runout, radial and silent operation. Two completely equipped gear testing laboratories are synchronized with production operations to guarantee the fullest measure of accuracy.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN



Gear laboratories and three of many precision tests in the production of gears for Milwaukee Milling Machines.



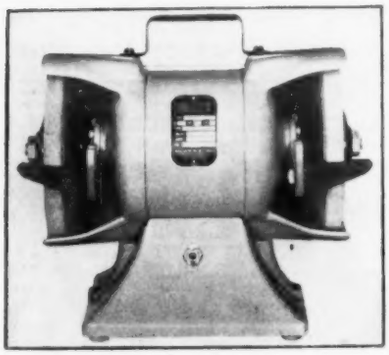
Milwaukee MILLING MACHINES

in. with a capacity of 500 tons, and a drawing stroke of approximately 60 in. with a capacity of 200 tons. It requires a 120 hp. motor.

Fig. 2 shows the large No. PM-75-DP20 unit for shell forgings from 125 to 180 mm. This machine is composed of a large piercing unit and a separately arranged drawing machine. The former has a rating of 750 tons and a maximum pressing stroke of 14 in. The latter is rated at 200 tons and has a maximum drawing stroke of 118 in. The piercing machine requires a motor of 150 hp., while the 120 hp. motor is used for the drawing machine. It is claimed that 40 mm. shells can be produced at a rate of more than 200-250 per hr., while 150 mm. shells are produced at a rate of more than 60-70 per hr. Wall thicknesses of shell forgings produced in these machines are said to be uniform, reducing outside machining to a minimum. Reject percentages are held to a low level.

Baldor Bench Grinder Has Capacitor Motor

The Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo., has announced development of a ball bearing bench grinder which uses 6 x ⅝ in. wheels. This grinder is powered with a capacitor motor which can be overloaded repeatedly without burning out. Base,



guards and tool rests on this grinder are made of cast iron. The tool rests are adjustable to and from the wheel. They also may be tiled for angle grinding. The motor is rated at ¼ hp., 110 volts, single phase, 60 cycles. This grinder weighs 36 lb.

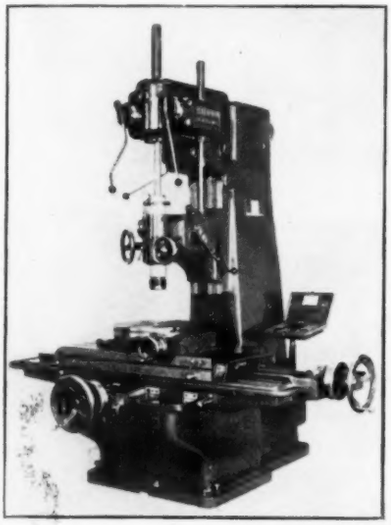
Bear Multiple Coil Welder Has Reactance Control

The "Arcmaster" a.c. welder offered by the Bear Mfg. Co., Rock Island, Ill., has a multiple coil transformer that is said to assure an even flow of current to the electrode. It is claimed by the manufacturer that the four coil transformer construction with reactance control not only levels the peaks and valleys of power variation, to provide a smooth flow of current to the electrode, but makes possible a uni-

form and constant welding voltage with calibrated amperage. The welder case is made of cast aluminum for rapid dissipation of heat. The unit is furnished in three models with ranges of 10-200, 10-250 and 10-300 amp. All models have 220 volt, 60 cycle wattage. Each unit is provided with a ground cable and an electrode cable.

Cleereman Jig Borers Have Power Rapid Traverse

Cleereman jig borers manufactured by Cleereman Machine Tool Co. and sold through its sales division, Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill., now are available with power rapid traverse for the table and carriage. This consists essentially of a built-in motor which drives the screw through worm gearing, a small reversing drum switch used in conjunction with a magnetic reversing controller. Power rapid trav-

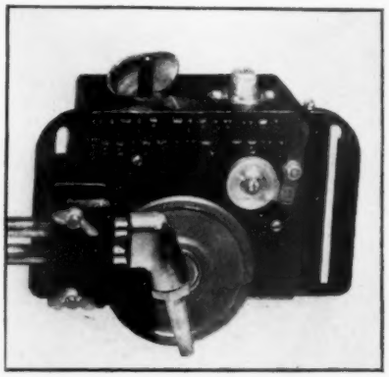


erse is available for either the longitudinal travel only, or for both the longitudinal and transverse travel.

A two jaw positive clutch is employed for engaging either the hand traverse hand wheel or the power rapid traverse worm gear. When power rapid traverse is engaged, the hand wheel is disengaged and does not rotate. The fine feed hand wheel is located on the end of the vertical motor shaft and utilizes the same worm and gear as the power rapid traverse. Limit switches are provided at each end of the travel to prevent accidental overtravel.

Motor Torch Announces Portable Cutting Machine

The Motor Torch Mfg. Co., P. O. Box 1571, Beaumont, Tex., has made available a portable, compact head adaptabel to any make of cutting torch for oxy-acetylene cutting operations. The self-contained power unit does not require any electrical connections. Speed is variable for both light and heavy plate. Straight lines, bevels, and curves can be cut in all positions. No

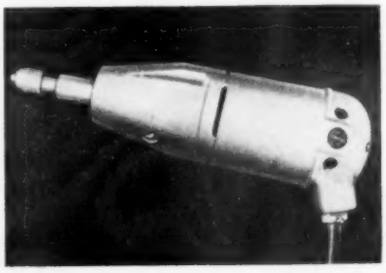


jigs or fixtures are required to start or finish the cut on the plate edge.

The torch holding adapters on this unit are adjustable for varying degrees of bevel. The spring operated motor is wound with a key shown at the top of the unit. The button shown beside the winding key provides speed control. A heat resistant alloy is used for the wheel which supports the unit and the torch. The unit is 7¾ in. long, 3 in. wide, and 7 in. high. It weighs 7 lb. Vertical adjustment is 4 in.

"Multi-Purpose" Tool Reciprocates 3/8 in.

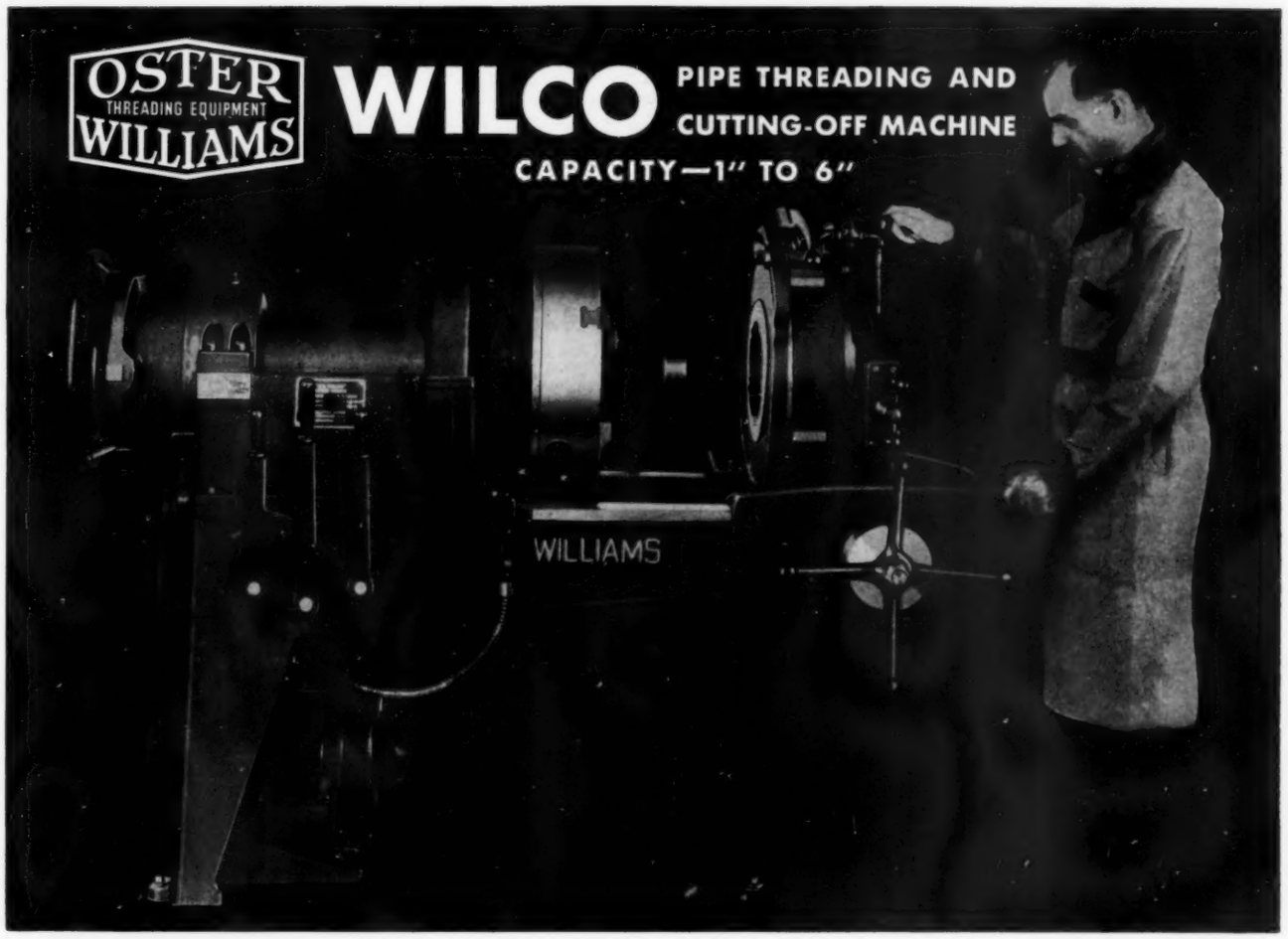
A reciprocating-action tool with more than three times the power of any model previously developed has been announced by H & H Research Co., 1925 W. Buena Vista, Detroit, Mich. With a stroke of ⅜ in., this Series "C" "Multi-Purpose" machine de-



OSTER THREADING EQUIPMENT WILLIAMS

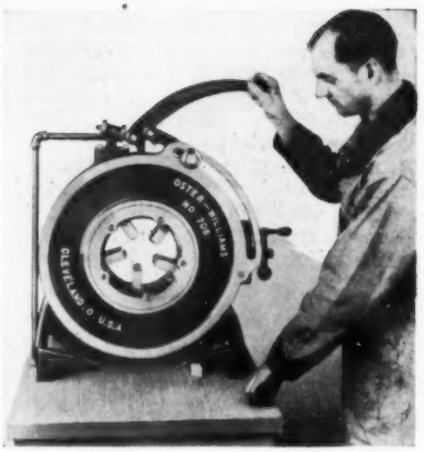
WILCO PIPE THREADING AND CUTTING-OFF MACHINE

CAPACITY—1" TO 6"



Preferred by Maintenance Men

Modern management rejects the old-style custom of using make-shift equipment and methods on maintenance work. Maintenance departments today are recognized as of basic importance to the efficient operation of manufacturing plants. For maintenance pipe-threading the national preference is the Wilco No. 706—a machine low in first cost but high in output, low in minutes-per-job but high in length of service. Read the two paragraphs at right . . . then send for complete descriptive bulletin.



This single die-head takes care of all sizes of pipe within range of machine without change of dies except when change of pitch is required.

Small dies held in massive holders mean a decided economy in die costs for Wilco owners.

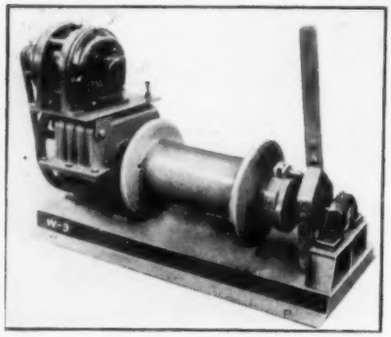
The OSTER MANUFACTURING COMPANY

Sales Offices: 2049 East 61st Street, Cleveland, Ohio
Factories: Erie, Penna., and Cleveland, Ohio
New York City Office, 30 Church St.
Threading Headquarters Since 1893

velops a 30- to 40-lb. push or pull at the end of the chuck. It may be used to file, burr, hone, snag, polish, saw and chip. Under full load it travels at 1,250 to 1,400 strokes per minute and will handle a ¾ in. square hone on heavy work and a $\frac{7}{16}$ in. one on lighter work. The machine is powered with 1/30 hp. universal 110-volt motor. Gear ratio is 4:1. Gears and bearings are of hardened bronze.

Stephens-Adamson Winch Incorporates Speed Reducer

The "Saco" speed reducer winch announced by Stephens-Adamson Mfg. Co., Aurora, Ill., is furnished in a variety of sizes to handle large or small capacities. One of the features of these winches is a jaw clutch which releases the pulling rope when disengaged. This feature is of particular importance where it is necessary to carry

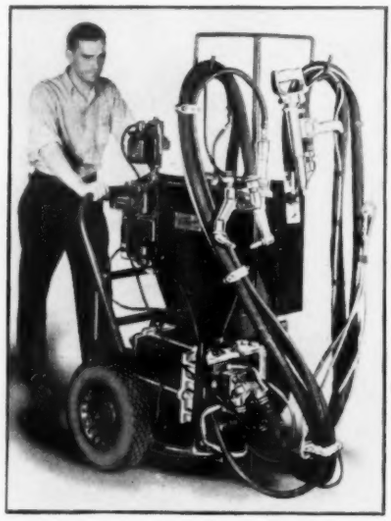


the pulling rope a considerable distance to attach to the object to be moved. Ordinarily, it is necessary for the operator to run a winch in reverse direction to pay out rope; with the jaw clutch releasing pulling rope this is unnecessary. The first reduction of these winches is through adjustable V-belts while the second reduction is through cut steel helical gears inside the cast iron housing.

Progressive Portable Welder Has Two Welding Guns

A two-gun portable spot welding unit has been made available by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. It is designed for heavy duty welding requiring high point pressures, large capacity transformer and adjustable weld time control. Equipped with pneumatic tires for easy portability, the unit is wheeled from one assembly location to the next as needed, rather than moving the work to the welding equipment. The unit can be used to serve a group of welding fixtures used for sub-assemblies, as well as occasional assembly line operation. Setting up for welding in a new location is a matter of minutes, since the only connections to be made are the air lines, water lines and the power lines.

The unit illustrated consists of two spot welding guns, transformer, air-hydraulic pressure booster, weld timer and contactor. Both the push gun (supplied with grounding clamp) and the scissors type gun operate from the single transformer mounted in the base of the carriage. Welding

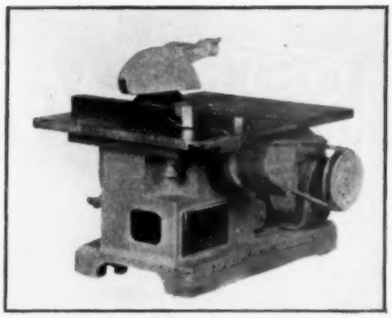


point pressures up to 1,000 lb. for the scissors type gun are supplied by the booster mounted above the transformer and operating from the standard factory air pressure line. Provision is made to water cool the gun jaws and the points through individual supply and return lines. The transformer also is water cooled. Guns other than those shown can be supplied, depending on the type of work to be handled.

When the unit is to be used for more than one type of welding, a special weld timer having two separate control dials permits adjustment for two separate weld times for each gun. In this case, each gun is supplied with two control buttons, the operator using the proper button for the work to be welded. With this type of timer, two operators can use both guns simultaneously on different types of work.

Crescent Abrasive Cutter Is Easily Portable

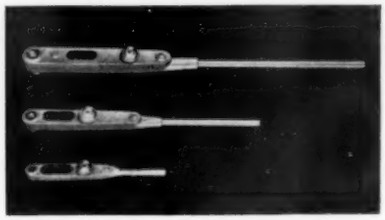
The Crescent Machine Co., 9 Cherry Fork Ave., Leetonia, Ohio, is offering a portable, motor-driven abrasive cutting machine having capacities for sheet metal up to 3/32-in. thick. The machine also is suitable for cutting tile and wood. Aluminum castings are used to keep the weight of this machine down to 71 lb., including detachable legs. The machine proper is 18 in. long, 13 in. wide and 8 in. high. The 8 1/16-in. diameter abrasive wheel projects 1¾ in. above the table for cutting tubing up to 1½ in. outside diameter. An 8-in. steel saw can be substituted for cutting boards. This self-contained unit is driven by a 1/3 hp. Westinghouse motor through a V-belt. Speeds of 3,500 r.p.m. are ob-



tained. The arbor is mounted on S.K.F. ball bearings, while the table is arranged to slide on steel rods.

New Torque Indicators Offered by Blackhawk

Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., has added a full range of torque indicators to its line. Models having maximum capacities if 133, 175, 420 and 1000 foot-pounds are available in two styles. For small assemblies, the 133 foot-pound "Torkflash", featuring a flashlight signal and pre-set tension, is available. The larger model features a sturdy "Stay-Set" dial. This



dial magnifies deflection of an inclosed spring-steel shaft 26 times, and remains at the maximum torque reading after tension is released. It is then reset to zero by turning the center knob.

Aerovox Capacitors For Fluorescent Lamp Use

Designed to be included in fixtures as initial built-in equipment, or to be added subsequently, a line of capacitors designed especially for fluorescent lamp power-factor correction have been announced by Aerovox Corp., New Bedford, Mass. These capacitors are of the oil-filled paper type and the flat metal can is hermetically sealed. Three types are available, taking care of power-factor requirements for the twelve standard types of fluorescent lamps in general use in industry.

"UCC" Photoelectric Units Made for Industrial Use

The No. 60 series of photoelectric controls, offered by United Cinephone Corp., 43–37 33rd St., Long Island City, N. Y., are housed in compact

inclosures having ½-in. knockouts in the bottom for power connections and a fourth knockout on the top for wiring an external photo-cell. Telephone-type relays ordinarily are provided, permitting a maximum noninductive load of 3 amp. a.c., at operating speeds up to ten per second. A microswitch to carry 8 amp., or another contacting device handling 15 amp. at 110 volts will fit the same housing. In the Model 60 unit, the photo-cell is separately housed, making possible the convenience of mounting the control as much as 5 ft. from the electric eye. Model 64 unit employs a 3-in. collector lens for applications demanding response from as little as 0.5 ft. candle with zero residual illumination.

NEW MATERIALS

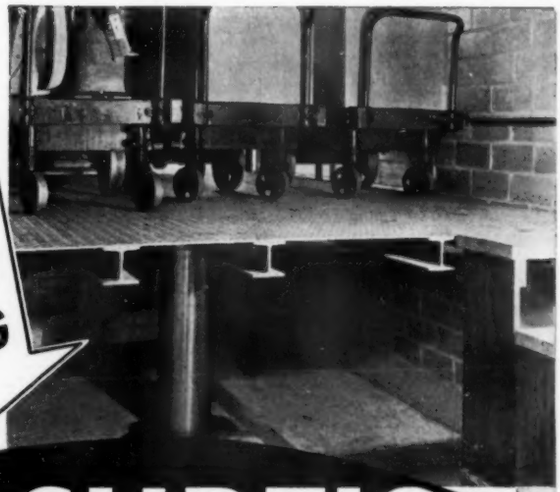
Durez Molding Compound Is Arc Resistant

Durez 8685 phenolic molding compound offered by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., was formulated specifically to prevent tracking where there is combined electrical spark and rubbing action. It has high resistance to carbonization under an arc. While slightly slower to cure in the mold, its electrical properties are materially increased by baking after molding. It is claimed to hold its high dielectric strength when used at moderately high temperatures. It is somewhat more flexible in its final set than standard materials, and does not crack under the expansion and contraction of metal inserts around which it may be molded easily.

Acheson Colloids Offers Adherent Lubricating Coating

A stable and highly adherent lubricating coating for use in prelubricating surfaces not readily capable of lubrication by ordinary means has been developed by Acheson Colloids Corp., Port Huron, Mich. The coating is applied in liquid form, either by dipping, brushing or spraying, and hardens on exposure to light. It provides a relatively high resistance to abrasion, and excellent lubrication and corrosion prevention characteristics are claimed.

Basic element of this coating, providing the lubrication, is colloidal graphite, while the presence of small amounts of hardenable organic colloids and a hardening agent, in a water suspension, render the composition photo-hardening in character. The coatings may be applied at normal temperatures or to surfaces heated up to 100 C. to promote drying. Lubricating characteristics are not affected by operation of the surfaces at elevated temperatures.



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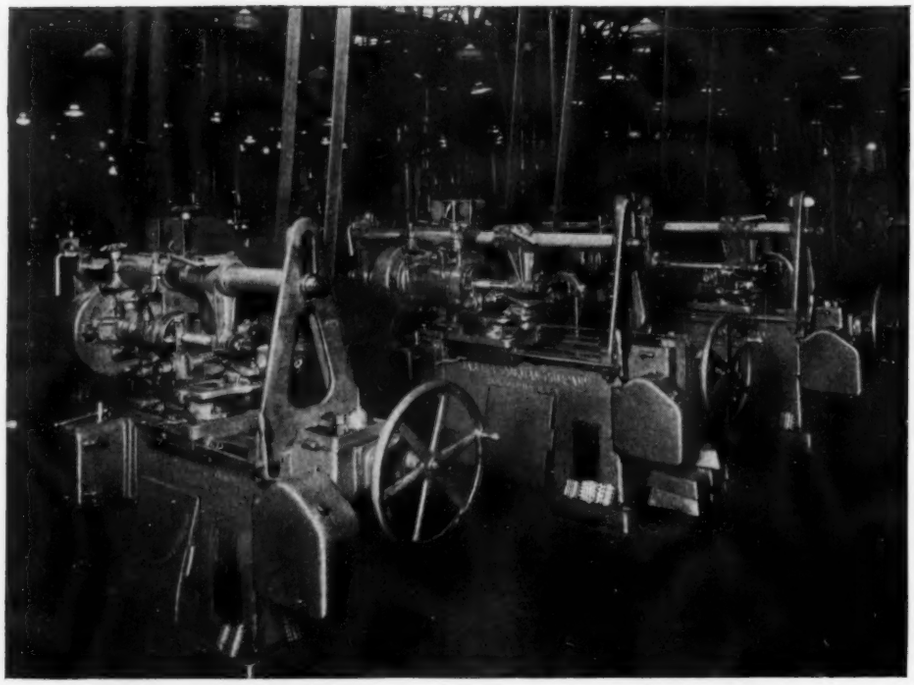
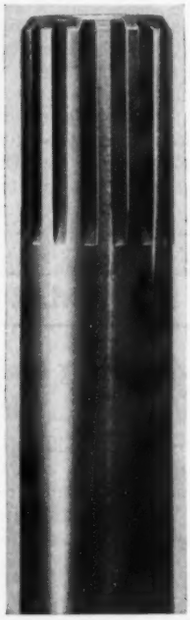
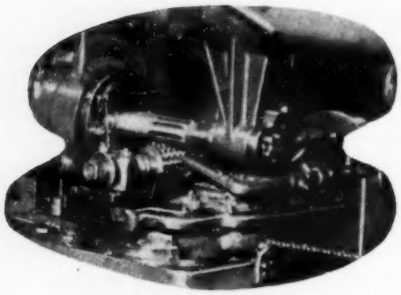


BARBER-COLMAN HOBBING MACHINES in automobile plant. The job is cutting splines. Cutter life increased 50% by changing to *Texaco Sultex Cutting Oil.*



A 50% INCREASE IN HOB LIFE ... without any sacrifice of finish or output... has resulted from using *Texaco Sultex Cutting Oil.*



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